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Three Paths to Profits Under the New Deal

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Balance in the wage structure, co-ordination of departments and activities, current executive control are more necessary than ever

"WHERE," business men are asking, "are my profits to come from if I must raise wages and shorten hours unless I can raise selling prices proportionately?"

There was much joy among the high cost, marginal producers when first reports were that the National Industrial Recovery Act was going to do away with anti-trust law restrictions on price fixing. Despair has set in in some quarters now that the administrator frowns on excessive, or immediate price raising. This does not mean that there will be no price changes. There will be proper adjustments of prices in the light of true costs.

It is perfectly obvious to the thinking business man that, if prices are raised proportionately to wages, all hands, employees and employers alike, will be just where they were before. There would be no increase in purchasing power, and after all the basic purpose of the law is to raise and spread purchasing power.

Fortunately, if the right steps are taken, unit labor costs, and therefore prices, need not rise as much as wage rates. That has been proved repeatedly.

The degree to which productive efficiency can be increased by labor-saving methods and machines differs widely from one plant to another. It is not my purpose to describe the methods which can be used to lower productive labor costs.

Preventable Waste

Instead, I want to point out the great amount of preventable waste that exists in so-called non-productive work in the factory, the office and the selling department. On the surface it may appear from what I am going to advocate that to cut those costs will involve adding to unemployment. That does not follow. Some un-needed help will admittedly be freed for the moment but with increased sales which will come promptly from lower costs those employees will at once be re-employed at useful work. Probably few of them will actually be out of work at all.

But the big saving will come from getting full value received from every dollar paid for wages and salaries and expense items.

Big wastes, even in concerns which are highly efficient and modern in their production methods, result from three very common faults: lack of balance in the wage structure, lack of coordination between departments and activities of the business, and lack of current executive control. I have seen otherwise well managed concerns wasting from $100,000 to $500,000 a year because of these three faults—as proved by the fact that they made just such savings when they attacked those wastes.

Let's see just how a company can secure balance, co-ordination and control. Suppose we start with wages, for they are at least as important as any other element—although many executives think first of sales. We will come to sales later.

I happen to have had the opportunity to become familiar with the wage situation in many concerns. This first hand observation proves—and I say "proves" advisedly rather than "indicates"—that wages are badly out of balance. There is marked disparity of wages between industries in any locality, considering the skill, intelligence and physical effort required of the workman. On the same basis there is inequality of wages between similar concerns within a given industry. And even within a single plant where it should be easy to arrive at a fair balance in basic wage rates, there are usually to be found glaring cases of over and under payment between men at adjoining benches or machines.

The importance of being prepared for the coming of higher wages cannot be too strongly emphasized.

The readjustment of wage bases is often the logical starting point in getting one's house in order. And by "readjustment" I imply neither flat cuts nor flat raises.

A few months ago when wage cuts were the fashion a well-known manufacturer refused to make an arbitrary horizontal reduction even though he was faced with the peremptory need to reduce costs. By intelligent readjustment he succeeded in reducing his direct payroll by 11 per cent but in doing so he actually increased some individual wage rates as much as 23 per cent. He got his wages in balance. Thus he not only saved money but got himself into a position where, if in the future wages needed to be either raised or lowered, he could more safely and fairly make horizontal adjustments. He is in a good position now that the National Industrial Recov-

ery Act is about to raise wages in his industry.

Here is another instance of a company which at just about the lowest point of the depression was cured of a serious and complicated illness by giving attention to getting its wage structure balanced and by coordinating and con-

Waiting for work slows down piece workers and arouses discontent

trolling its activities. In telling of it, I shall have to mention some matters concerning other phases of the business—even going so far afield from wages as sales methods and policies. That in itself shows clearly how interdependent are all angles of a business, how impossible it is to divorce one from any of the others and therefore how important it is to coordinate them.

It also proves that the symptoms of internal trouble that appear on the surface do not always show exactly what is wrong inside. A rash does not necessarily indicate that the pinkish one has measles. He may have scarlet fever or the itch, or may merely have been gorging himself on strawberries.

The symptoms displayed by this particular business were a threatened strike of the workers on account of their low earnings in conjunction with a loss in sales volume greater than the average decline for the industry as a whole. The president was convinced that treatment involved liberal dosages of wage increases in the face of a general decline that was then taking place in the wage levels of the industry, and a major operation on the sales department.

A deep-digging general examination of this client's condition indicated entirely different treatment. The wage rates he was paying were high enough—in some instances too high. The sales department was all right. The trouble was elsewhere, but you couldn't tell merely from the rash just where it was.

The dissatisfaction of the employees was due not to the wage scale nor to the small size of their pay envelopes, but to the fact that they regularly had to wait for work to come to them. To earn on piece-work three or three-and-a-half days' pay they had to spend four to four-and-a-half days in the plant. The labor trouble thus went back to poor equipment layout, ineffective production planning and a low level of production activity—and the even more fundamental lack of coordination.

Thorough study of the sales side of the business showed no cause for complaint as to personnel. The salesmen were intelligent and unusually hard-working. But the customers complained that deliveries were bad and getting worse. Furthermore, it developed that while the trend of prices was downward the company lagged behind its competitors in making the inevitable reductions. It followed the trend only when finally forced to and so was continually out of line. Consequently it lost out on the volume business but was ultimately forced to take such fill-in business as it could pick up at the low prices it should have quoted at first. This small business had to be taken at a loss, for the costs were far too high.

There were several reasons for this. Chief among them was the basic mistake which is common to probably 60 per cent of all manufacturing today. The company had laid out its plant to manufacture its product on a straight mass basis. That was well enough in the early days of the industry, but as competition grew sharper it became necessary to produce a greater variety and to change designs frequently. That could not be done effectively on a mass basis. What was needed was a revised layout on what might be called a "job-mass" basis, which would permit quick change-overs with a minimum of expense. The attempt to stick to true mass methods caused the delays to which both the employees and the customers objected and helped to keep costs, and hence prices, high.

Another factor in this was the management's over-shrewdness in delaying raw material purchases as long as possible in the declining material market. While this saved some money it frequently held up production and aggravated delays.

The first thing done was to put the plant layout, the production planning, the material control and the cost methods on a job-mass basis. With the house so far put in order, attention was given to getting the wage scale in balance as a preliminary to installing proper and well adapted wage incentive methods.

The aim was to make certain that what each worker earned would be an accurate index of the value of his services to the company. Inequalities were brought to light and corrected.

Great care was taken to make sure that the skill element was accurately reflected. There are few plants which have been operated as little even as ten years in which the skill required for many operations has not radically changed in that time. Usually the skill required has declined, yet this transfer of skill from the man to the machine is seldom reflected in the wage scale.

Too Big a Spread

In this plant, for instance, the design of the product and the methods used had been improved and standardized to such an extent that the skill required in the final operations had been reduced 35 per cent to 40 per cent. Yet the operators' rate of pay still remained 110 per cent above the general unskilled rate. At best the rate should have been not more than 75 per cent above the unskilled wage.

Incidentally, in another shop I saw another striking instance of this discrepancy. A mechanic was engaged on a certain lathe operation that was supposed to require great all-around skill. His production was fourteen pieces per day.

Once, when he was sick, his job was turned over, with great misgivings, to an apprentice whose wages were naturally much lower. To everyone's amazement he turned out 56 pieces a day—four times as much as the higher paid man. Such unbalanced wages are costly and unfair.

But to go back to the other plant:

Once the basic rates had been equal-

An example of discrepancy in wage rates. 14 per hour on journeyman's wages—56 per hour on apprentice's wages

ized and put into balance, wage incentive plans were put in wherever they were warranted, specially designed to be most effective. It is seldom that the same type of incentive will work equally well in all departments of a plant.

The corrections improved conditions at once. Where formerly it had taken twelve to fourteen days to complete an order, six days became the rule. There was no waiting time for the workmen. They put in only three days at the plant in order to earn three days' pay. Costs came down to such an extent that prices could be lowered. That brought sales sufficient to put the plant on a 75 per cent of capacity operating schedule—and to make a profit. The management estimates that the annual savings are easily in excess of $160,000.

In Balance

And, contrary to the management's expectation, it was necessary neither to raise wages nor to operate on the sales department. The company is now in a position to meet higher wages when they come. It is in balance.

Here is an example that shows the need of coordinating cost finding methods and selling. It is of a manufacturer in a branch of the metal working industry which has been cursed by what many competitors stigmatize as "gyp" competition. On the face of things it appeared impossible for him to meet the low prices which the so-called "gyps" quoted on certain items. But by making needed corrections of errors in the allocation of certain elements of cost and by making the cost methods reflect the actual facts of the case, the management found for the first time what those items actually cost. By reflecting these costs in the selling prices this manufacturer was able to compete successfully with the "gyps" on their own basis.

Investigation had shown that the apparent "gyps" were not carrying charges for patent amortization, experimental or research work, idle plant and similar charges, against the cost of the product, for the excellent reason that they did not have those charges. Nor were they incurring any costs to speak of for sales promotion or advertising—the low price was all the incentive needed.

Our friend, because of his general expense allocation policy, was fallaciously carrying charges for all of these things to the products with which he was trying to compete with the "gyp." He revised his cost allocation to make it accord with the facts. That showed that the true costs on the items on which the "gyp" competition was particularly keen were as low or lower than the costs of those who were formerly thought to be "gyps." So, he was able to quote competitive prices and get his share of the business. Sales in number of units during 1932 were ahead of those in 1931 and a loss in '31 of $16,000 was turned into a profit of $27,000 for 1932.

The successes while industry operates under the National Industrial Recovery Act, and after, are going to be enjoyed to an unusual degree by those concerns which have highly intelligent management. Even the best tools of control will obviously not give the needed close executive control unless they are employed by thoughtful, intelligent men.

As an example, a manufactured article, the average price of which a few years ago was $12.50, is now selling at $2.95. At that time L. C. L. freight to the maximum shipping zones amounted to $0.37 per unit, equal to 3 per cent of the sales dollar. The freight rate to those zones is still $0.37 per unit, but at the current selling price this is equivalent to 12.2 per cent of the sales dollar. A number of concerns in that industry are continuing to attempt distribution throughout the greater part of the United States on this basis. One company by giving up any attempt at national distribution and concentrating its sales effort within the new, feasible shipping range of its plant and in territories served by water shipping, has brought its freight cost back to 2.4 per cent of the sales dollar on the new selling price of $2.95.

Deceptive Savings

In another instance, the management attempted to overcome partly the high ratio of freight cost by forcing a high percentage of its sales into carload shipments. The apparent savings amounted to some $75.00 per car, but the dealer was encouraged to buy in amounts beyond his financial ability. The result was that the time in collection increased some 45 days. Simple interest at 6 per cent on the additional tie-up of working capital amounted to some $60,000. More important, the credit risk was greatly increased. The increase in bad debt loss will likely exceed many times the savings in freight of $75.00 per car.

All of the instances I have cited in this article show how entirely preventable wastes have been caused by lack of coordination or balance or control, or all three. In no case would adequate control have prevented the wastes, but in every case the control mechanism would have screeched the fact that the waste existed.

By reducing the preventable wastes in "non-productive" salaries and wages caused by lack of balance, co-ordination and control, most companies will make savings large enough to reduce the cost of their product appreciably.

Just How Progressive Are We?

H. G. WALKER

We have three classes of shop managers in this country: those who buy new equipment that can prove its worth; others who wait until purchase can no longer be delayed, losing its economies over a long period; and those who delay purchase so long that the sheriff takes them over.

Too many of our so-called managers fail to appreciate the real economies urged by the production men. They cannot see why the shop needs a new machine or attachment when the old one has done the work for so many years. They scrutinize labor costs more closely than any other item, but fail to realize how hours can be saved by a small investment in machines, tools or fixtures. Their idea of management is to spend as little as possible regardless of the returns on the investment.

Five years ago a tool costing less than $100 was shipped to a railroad shop, at the request of the master mechanic, who knew its value. It was sent on trial. The M.M. fondly believed that he could point to the savings effected and have the tool ordered and bought in the regular way. The tool saved its cost in two months. But five different requisitions sent through by the M.M. were returned, even though he plainly stated the savings effected. The tool was finally returned to the builder.

Sometimes the Purchasing Agent is the one who wastes money, by not spending it. He considers it his job to prevent expenditures, rather than to buy money saving equipment. He frequently prevents knowledge of new machines getting to the production man. And even where the shop man, through the *American Machinist* and other sources, learns of new and efficient machines, the P.A. sometimes refuses to let the representative of the new machine see the shop executive.

Shop superintendents and foremen are responsible for shop costs. Yet they are frequently treated as irresponsible creatures who must not be seen by sales engineers. The P.A., whose job is to *buy* and who has no responsibilities for production costs should have no jurisdiction over the shop executive.

The general manager must decide how much money can be spent for new equipment that will save money. The shop executive must show the management what can be saved, and should not be held responsible for costs when his advice is ignored.

We hear a lot about the progressiveness of plants in this country. But there is still room to ask—just how progressive are we?

Multi-Blade Cutting Tools

Their Design and Use—III

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Boring tools, roughing and finishing, are discussed particularly in regard to cutting angles, methods of holding the blades and permissible speeds on various materials

MULTI-BLADE boring tools are used for both roughing and finishing. When used for roughing, they are called core drills or rough boring heads. A finish boring head is a reamer.

Multi-blade boring tools having inserted blades are either of the expanding or the adjustable type. Expanding reamers, Fig. 15, have means whereby the cutter blades are all unlocked and moved outwardly together. For the regular reamer type of cutter, adjustment is thus facilitated.

For simpler tools, or for combination tools, the adjustable type is used. Here the blades are disassembled from the cutter and readjusted by inserting shims or moving out along serrations. Many types of blade locks have been developed; the serrated type in several modifications is popular today. The serrations may be broached in the cutter body, as in Fig. 16, so that, after each blade is removed, it may be inserted one tooth ahead. The cutting edge is thus moved out only a part of a serration, and the amount left for regrinding is minimized. The pitch of the serations should be an even multiple of the amount of offset between adjacent blades.

With the adjustable blade tool, care must be exercised in locking up the blades so that an even stress is obtained throughout the body. The locking means should be lightly tightened once around and then set up around the body several times so as to increase the locking pressure gradually and evenly. All inserted blade tools, whether of the expanding or adjustable type, should be reground after blade readjustment. It is impractical to obtain accurate work otherwise.

Table I—Number of Blades in Boring Cutters

Rougher	
1½ to 2¾ in. dia	4 blades
2¾ to 4½ in. dia	6 blades
4½ to 10 in. dia	8 blades
10 in. dia. and up	10 blades
Finisher	
1½ to 2½ in. dia	6 blades
2½ to 3 in. dia	8 blades
3 to 4 in. dia	10 blades
4 to 5 in. dia	12 blades
5 to 8 in. dia	14 blades
8 to 10 in. dia	16 blades
10 to 12 in. dia	18 blades
12 in dia. and up	20 blades

Naturally the blades of a roughing tool are somewhat coarser than for finishing to give more strength. The wider tooth spacing in the body also allows a stronger support. Better cutting efficiency is secured by taking heavy cuts in roughing, as there is less power consumed and less blade wear proportionately. Finishing tools require more blades to reduce the feed marks and, therefore, take a finer cut. The number of blades for each varies with the diameter. The number of blades for different diameters is shown in Table I. These recommendations may be reduced for combination tools to permit the blades for different diameters to be interspaced.

Another consideration in boring cutter design is the tooth spacing, not the number of blades as mentioned previously, but the spacing from one blade to another. If a slight irregularity is allowed, it minimizes the effect of chattering; that is, each blade is placed a degree or two ahead or back of its correct index. The theory is that any stress caused by the resiliency of the cutting action is thus made irregular and will be reduced. A further improvement is obtained by using an odd number of blades for the cutter; this, however, makes it more difficult to gage the cutter. No calipers may be used, unless a measuring point or screw is placed opposite one of the blades. The real remedy for chattering is proper support for the cutting tool. On thin work, however, the above features may have to be used.

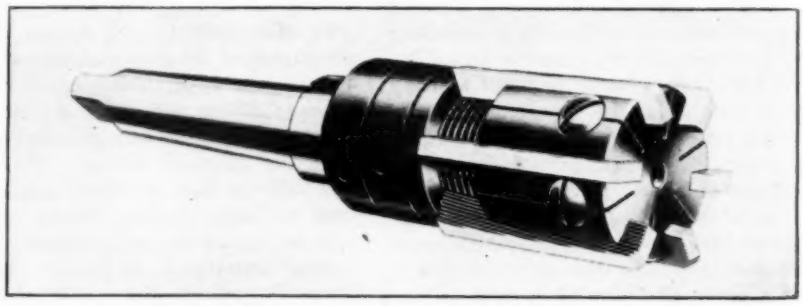


Fig. 15—In this expanding reamer, all blades are moved outward simultaneously

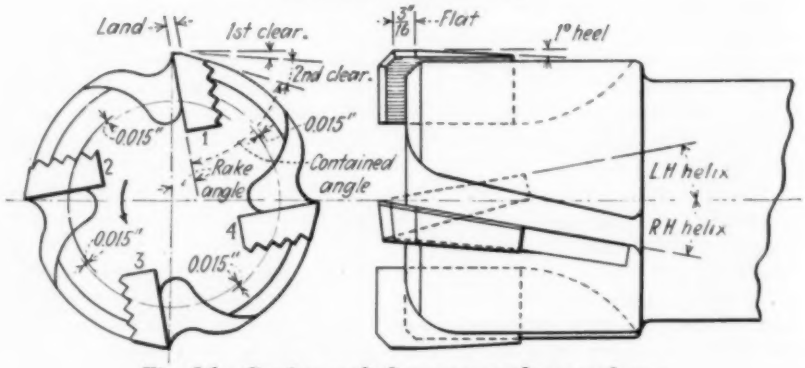
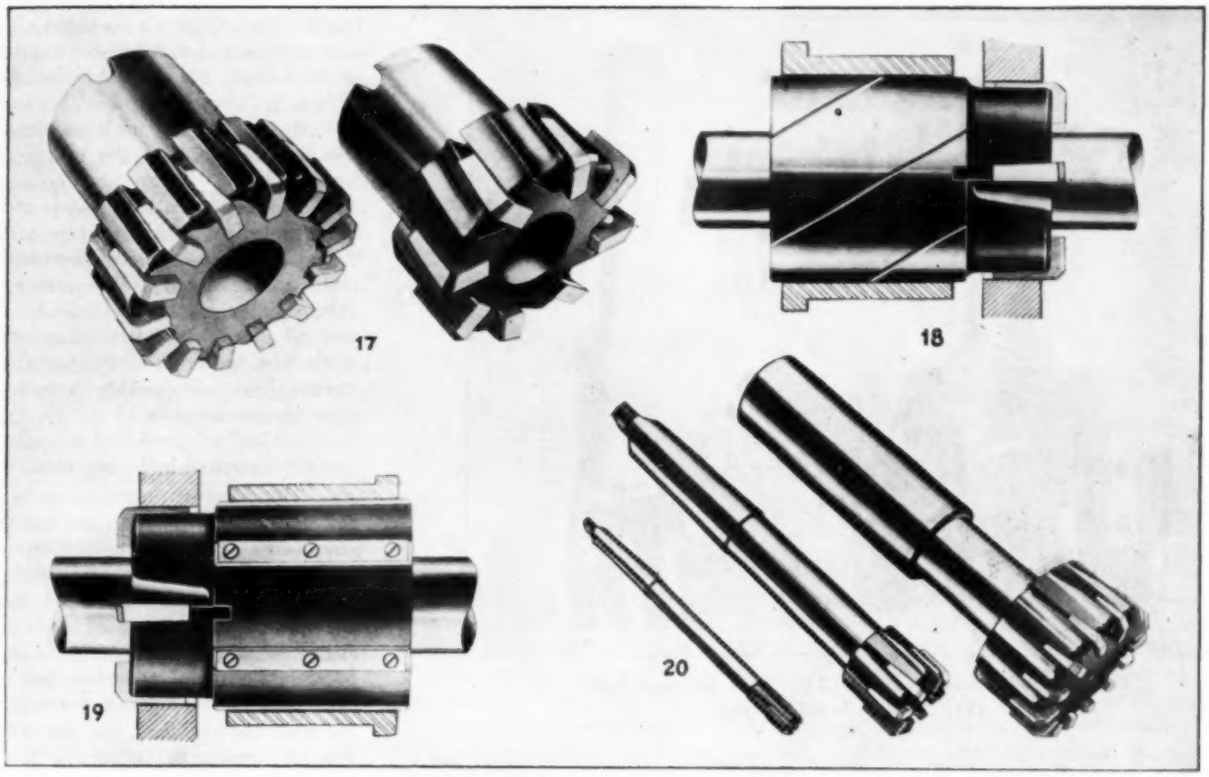


Fig. 16—Cutting and clearance angles are shown on this adjustable reamer with offset serrations



A group of inserted blade boring tools. Fig. 17—Adjustable reamer and core drill, shell type. Fig. 18—Boring tool with piloting body. Fig. 19—Boring tool with strip pilots. Fig. 20—Adjustable reamers with shanks

The angles of the cutter blade are varied for roughing, for finishing and for the material being cut. There are two angles to be considered in the relation of the position of the blades to the body. The rake angle, Fig. 16, is the angle between the front line of the cutting edge with a radial line from the center of the cutter. The helix angle is the angle between the outside cutting edge and the axis of the cutter.

As a general rule, no rake is used on either rougher or finisher; that is, the blades are set radially. However, if the material to be cut is either steel or aluminum and the tool is piloted or properly supported, rake may be used advisably, for less power is then required to pull the cutter. No rake is seen on the smaller cutters, say under 3 in., for the reason that they cannot be adequately or rigidly supported because of the small diameters. In the larger cutters, improvement in performance is quite noticeable with rake. Chattering, however, will result unless this rake is used intelligently; a general figure is 10 deg.

For cast iron or brass, no rake nor negative rake is used. Rake tends to pull the cutter into the work, and if the hole being rough bored is off center or eccentric, the cutter is pulled to one side. Hence, an important requisite is that the cutter be properly guided. The digging effect is the reason for using no rake on brass because of its softness. No rake is desirable on tools for cast iron because the contained angle, Fig. 16, should be as great as possible. The hard skin of cast iron breaks down the edge so the section at the cutting edge should be large. Negative rake, where the tool is put ahead of the center, tends to steady the tool, although making the cutter run harder requiring more power. Table II shows correct angles for cutters, roughing and finishing, considering the diameter and the material being machined.

Helix angles vary in commercial tools much more than rake angles. In fact, they are considered more important. Helix angles are designated as right- or left-hand, depending on the angle of the blade. A right-hand helix is generally used on the roughing cutters; this permits an easier cutting tool. As the roughing tool takes off considerably more metal than the finisher, anything that makes it cut easier should be used. It should also be noted that any deflection from the dragging-in action, caused by the helix angle, will not be so marked in affecting the diameter of the work as the rake angle; however, alignment with the bore is affected. The finishing cutter generally has the blades set straight, or if a straight hole is to be guaranteed, negative spiral is used.

Clearance angles measure the relief from the land of the cutter to prevent it from dragging. They should not be greater than necessary, as they only reduce the contained angle, which should be as large as possible to retain strength

Table II—Cutting Angles for Boring Tools

	Steel								Cast Iron or Brass								Aluminum							
	Rougher				Finisher				Rougher				Finisher				Rougher				Finisher			
Dia.	Rake	Clearance	Land	Spiral	Rake	Clearance	Land	Spiral	Rake	Clearance	Land	Spiral	Rake	Clearance	Land	Spiral	Rake	Clearance	Land	Spiral	Rake	Clearance	Land	Spiral
1½"	0	6°	☆	5°	0	6°	☆	5°	0	4°	☆	0	0	4°	☆	0	0	6°	☆	10°	0	6°	☆	5°
2"	0	6°	☆	5°	0	6°	☆	5°	0	4°	☆	0	4°	4°	☆	0	5°	6°	☆	10°	5°	6°	☆	10°
2½"	0	6°	☆	10°	0	6°	☆	10°	0	4°	☆	0	0	4°	☆	0	10°	6°	☆	15°	10°	6°	☆	15°
3"	5°	6°	☆	10°	0	6°	☆	10°	0	4°	☆	0	0	4°	☆	0	15°	6°	☆	15°	10°	6°	☆	15°
4" Up	10°	6°	☆	10°	0	6°	☆	10°	0	4°	☆	0	0	4°	☆	0	15°	6°	☆	15°	10°	6°	☆	15°

Reamers with shanks. Fig. 21—With piloting body. Fig. 22—With pilot strips

and heat conductivity of the cutting edge. If a cutter chatters, it is probably too sharp. Reduce the clearance. If it is noisy, reduce the land or increase the clearance angle.

The outline angles are also shown in Fig. 16. The front or entering edge may best be chamfered, or rounded, as it breaks up the chip. This is followed by a slight flat, which eliminates the showing of feed marks. The balance of the blade is relieved to the heel which is further chamfered. This prevents the tool from catching and tearing the finished bore when being removed.

Clean, accurate smooth-bored holes are not generally attained with a single pass of the boring tool. Two or more cuts are required. The roughing operation may be an eccentric cut; that is, it may remove considerable metal on one side of the bore and little on the other. This one-sided cutting action necessitates leaving additional stock for finishing. The amount, varying with the diameter, is indicated in Table III. Semi-finishing is necessary only on the most accurate work.

Many different cutting materials are available today. Each has its superior application. The most popular is high-speed steel which has an application to all metals. Unless particularly hard materials are being machined or better operating conditions than usual are available, high-speed steel will be found generally satisfactory.

In machining alloy steels, hard cast iron and the like, greater wear may be obtained on the cutting edge by the use of super-cobalt high-speed steel. This material is an excellent compromise between high-speed steel and the alloyed or carbide cutting materials such as Stellite and tungsten carbide. J-Stellite is well known as a superior cutting product, particularly on hard or chilled cast iron surfaces. It should be used with care, properly fitted into the cutter body, as it is more brittle than the high-speed steels. Cemented carbide can be used where the other cutting metals will not stand up to the hard wear encountered or where quantity production and adequate machine tool equipment is found. The cutter blades to which tungsten is tipped should be securely located in the body. Blades should be of thick section to absorb the heat and should be fully backed up both on the diameter and in front of the cutter in the cutter body.

Table III—Allowances for Roughing and Semi-Finishing

Diameter	Roughing	Semi-Finishing
2 in. and under	0.025 in.	0.005 in.
2 to 10 in. dia	0.030 in.	0.005 in.
10 in. dia. and up	0.060 in.	0.010 in.

The suggested cutting speeds at which these materials should operate is shown in Table IV. No positive recommendations can be given as the power available, rigidity of the tool spindle or jig, method of piloting, structure of the work, the material and its manner of working, are all variable factors. The approximate formula of:

$$\text{Approx. speed (r.p.m.)} = \frac{\text{Cutting speed in ft. per min.} \times 4}{\text{Diameter of cutter in inches}}$$

will give the revolutions per minute for any cutter by simple calculation.

The feed of a boring cutter varies with the operating conditions, the same as the speed. For adjustable blade cutters, either roughing or finishing, an amount of about 0.010 in. per blade per revolution can be considered correct. This gives an approx. feed (in. per min.) = No. of blades in cutter $\times$ 0.010 $\times$ r.p.m. On combination tools the above will probably prove excessive because of power requirements and chip clearance.

Many body designs of multi-blade boring tools have been worked out. Core drills or reamers with a hole as shown in Fig. 17 are known as the shell type. The bore may be tapered or straight, and the drive made through a keyway in the bore or on the end as shown. The body may be modified for piloting purposes. A turned journal, pack hardened and ground integral with the body, may be used as in Fig. 18, or with strip pilots as in Fig. 19. The latter design permits the piloting diameter to be maintained by shimming under the strips and regrinding to size. The piloting diameter may be larger than the boring diameter for short bores, guiding the tool near and before the work and allowing the boring cutters to be withdrawn through the pilot bushing.

Table IV—Cutting Speeds for Boring Tools

	Roughing				Finishing			
	H.S.S.	Super-H.S.S.	J-Stellite	T.C.	H.S.S.	Super-H.S.S.	J-Stellite	T.C.
Copper	120	150	200	300	150	200	250	400
Brass								
Cast Iron	50	75	100	150	60	90	110	200
Bronze								
Semi-Steel Cast	50	75	...	....	60	90	...	....
Steel Cast	40	65	...	....	50	75	...	....
Machine Steel (0.15-0.20)	60	...	...	....	75	...	...	....
Steel (0.30-0.40)	50	75	...	....	60	90	...	....
Alloy Steel	40	60	...	....	50	75	...	....
Mall. Iron	60	85	120	175	75	100	130	200
Aluminum	250	300	400	1000	300	400	500	1000

Similar tools are designed with only solid shanks. Reamers with solid shanks are illustrated in Fig. 20. Figs. 21 and 22 show corresponding piloting bodies with solid shanks. The shanks may be of the regular standard taper or of the quick-change type.

The function of every boring tool is to perform smooth, accurate work. The method by which it is guided through the bore determines the results attained. If no pilots are used, machine tool spindles must be rigid and accurately aligned. For final smooth hole boring, a floating holder is used to carry the reaming head. This automatically compensates for turrets, which index out of alignment, or work inaccurately located. In many commercial designs much thought has been given to correct alignment and guidance still retaining a full floating action for the cutting tool. Where compactness is necessary, the cutter body can be built directly into the floating holder by incorporating the usual thrust ring in the body and using the rest of the holder for the blades.

Blueprints Used as Templets
Discussion

JOHN E. HYLER

Touching upon the use of blueprints as templets, as described by John Aures (*AM*—Vol. 76, page 928) and discussed by Richard Overman (*AM*—Vol. 77, page 871), I quite agree with Mr. Overman that a blueprint is never to be depended upon as a templet for accurate layout. I also think that his solution of the problem is an excellent one.

However, not all the inaccuracies of blueprints can be laid at the door of stretching in the printing machine. Since the prints are made wet in the process of washing, and are then dried, or allowed to dry, the paper first swells and then it shrinks. Mechanical uses are made from the shrinkage of drying paper in some cases that might be cited. When the draftsman wants to stretch his paper tightly on the board, he wets it, makes the edges fast and lets it shrink tightly in drying. When it is desired to make a tight joint between pieces of wood veneer, straight pieces of veneer are fastened together with gummed paper tape. As the tape dries, it shrinks and pulls the edges of the veneer tightly together.

My experience with blueprints is that they are not always "out" from the standpoint of stretching, for I have had some that were out as much as $\frac{1}{8}$ in. per ft. Paper is composed of fibers felted together, and uneven shrinkage or expansion follow humidity changes or wetting and drying.

Up To Industry

DISCUSSION

R. E. FLANDERS
President, Jones & Lamson Machine Company

MOST of us who are engaged in industrial undertakings are in full sympathy with the purpose of the National Industrial Recovery Act. Most of us likewise are not merely willing to cooperate in putting the Act into effect, but are most anxious to do so, believing that its provisions can be made effective in promoting a return to a more nearly balanced operation of our national economy.

There are, however, many of us who are enthusiastic and willing, but who are seriously concerned with some implications being read into the situation which are unjustified and dangerous. As examples of these unwarranted implications, it is urged that every industrialist study a copy of Mr. Richberg's speech (*AM*—Vol. 77, page 457), or Dr. Tugwell's leading article in the New York Times Sunday magazine for July 16.

The purpose of both the speech and the article is beyond criticism, being to urge the most speedy and thorough cooperation between industry and government in a joint experiment on which they have embarked. The dangerous element lies in the assumption, tacit or expressed, by both of these gentlemen that the depression was due to industrial factors and that we can be gotten out of our present condition, and kept out of similar future ones, by appropriate industrial policies.

A more useless doctrine could scarcely be spread abroad. It causes false hopes and at the same time diverts attention from the really serious faults and mistakes of the last quarter century.

The causes of our present condition are, or ought to be, pretty well understood by this time. In part they were due to an agricultural speculation whose foundations were laid in pre-war conditions. In larger part they were due to the inevitable results of war inflation, recovery from which in case of any major conflict has resulted in distress and disaster to both agriculture and industry ever since the industrial revolution. In great part the present situation is due to a more or less typical business cycle of unprecedented magnitude superimposed upon the other disasters mentioned. This cyclic disturbance was built upon industrial success; and some measure of responsibility for it must lie with us in the initial disproportion in the division of the returns from industry as between those who spend and those who invest.

Yet the whole fabric of the speculative structure which was reared to such enormous heights and which fell with such disastrous results was engineered and constructed by the operations of speculative finance, with which industry as such is not concerned.

It is time for productive industry to separate itself from speculative finance, whether in its purposes, habits of thought or public reputation. It is time for productive business to urge that the permanent remedies for recovery be built about the causes of disaster. It is necessary for us, while whole-heartedly backing these hopeful emergency proposals for initiating recovery, to extricate ourselves from the assumption of responsibilities which do not belong to us, and of which the admission would lead to useless and harmful theories of economic control.

Standards for Production Control—III

ALLEN M. LINDSLEY
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Metallurgical Laboratories, Inc.

Articles I and II of this series gave standards for gear shaping and hobbing respectively. The author now treats the subject of gear milling

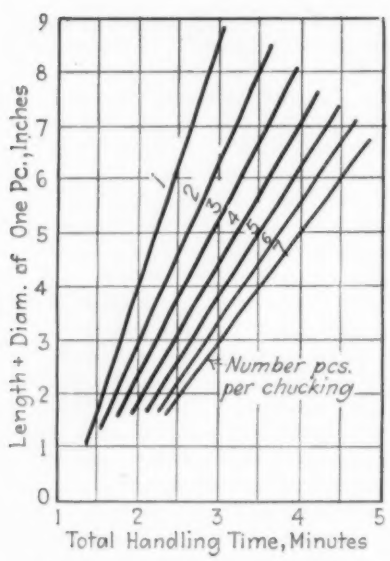
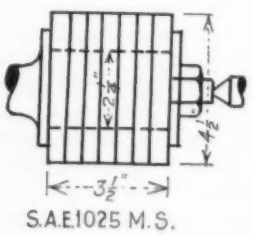


Fig. 9—Handling time for No. 13 B&S Gear Cutter



Cutting Gear Teeth Allowances

To actual time add 10 per cent of cut, 15 per cent of total actual: add 40 per cent premium allowance.

Chuck and remove 7 pieces	4.00
Cut 52T, 12P, 5⅝ ft. feed	44.20
10 per cent cut	4.42
15 per cent	7.89
Standard time, 7 pieces	60.51
St. 'ard Time, per piece	8.64
40 per cent	3.46
Premium Time, per piece,	12.10 min.

THE THIRD practical application of time standards is shown in the standards illustrated for use with the No. 13 B & S bevel gear cutting machine. This machine is a specialized type of automatic milling machine. Not being a generating machine, it produces bevel gear teeth approximating the exact shape only and is often used to rough out teeth preparatory to a final operation. The machine is well adapted for cutting spur gears, ratchets and clutches and is so used.

The data are self-explanatory, Tables VI and VII listing practical production feeds and speeds. Fig. 9 shows the total handling time for different sizes of parts and numbers of pieces per chucking. It also carries an illustration of the method of applying the standards for the benefit of the planning department clerk. It will be noted that the premium allowance is based on the addition of 40 per cent of the standard time. This machine, as mentioned in Article II of this series, was operated by the same worker

Gear-Cutting Data

Work capacity: spur and bevel gears to 18-in. O.D. x 4-in. face.
Cutter capacity: 3⅝-in. O.D. x 1⅜-in. thick.
Speed of constant speed pulley: 435 r.p.m.
Rate of carriage return: 100-in. per minute (0.01 min. per in.)
Indexing rate: 0 to 24 teeth = 0.04 min. per tooth.
25 to 49 teeth = 0.02 min. per tooth.
50 up = 0.01 min. per tooth.

Table V. Working Length of Expansion Bushings and Solid Arbors

O.D. of Bushing	Work Length	O.D. of Arbor	Work Length
¾ to 1 3/16 in.	3 in.	⅝ & 11/16 in.	3 in.
1¼ to 2¼ in.	3½ in.	1⅛ in.	4¼ in.
1 & 1⅛ in. (special)	4 in.	1½ in.	3⅛ in.
		2¼ in.	3½ in.

Table VI. Feeds and Speeds for Gear Teeth—One Cut

Diametral pitch	6	7	8	9	10	11	12	14	16
Low C machine steel	4⅝	4⅝	5⅝	5⅝	5⅝	5⅝	5⅝	6⅞	6⅞
and C.R.S. 90 ft. per min.	110	119	119	125	145	145	153	162	162
Cast Iron	5⅝	6⅞	6⅞	6⅞	6⅞	8¼	8¼	9⅞	9⅞
100 ft. per min	122	132	132	139	161	161	170	180	180

Feeds given in inches per minute. Speeds given in revolutions per minute.

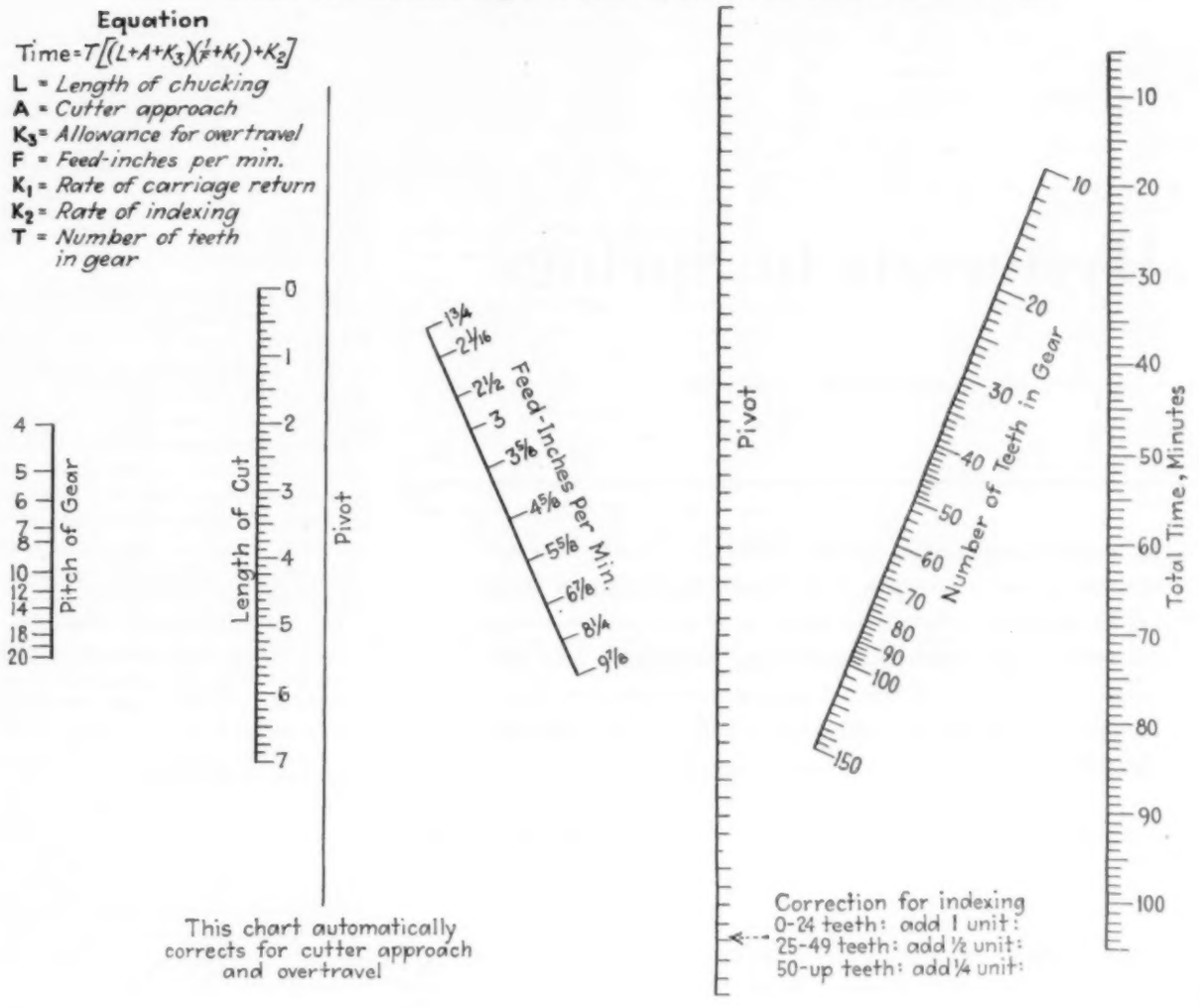
Table VII. Feeds and Speeds—Clutch Teeth

Using fine, straight-tooth side mills

Material	Cutter O.D.	Cutter r.p.m.	Size of cut	Feed
Cast iron	2½	153	11/16 in. w x 1/16 in. d.	6⅞
S.A.E. 1112 C.R.S.	2¾	125	1/16 in. w x ¼ in. d.	5⅝

The expansion sleeve and arbor must be used with all gears of average proportions, where the length is not less than 25 per cent of the diameter. Where length of piece is short compared to diam., use solid arbor with washer and clamping nut.
Use expansion stub arbor for clutches.

FIG. 10 - Chart for Estimating Production on No. 13 B&S. Gear Cutter


Equation
Time = T[(L+A+K3)(1/F+K1)+K2]
L = Length of chucking
A = Cutter approach
K3 = Allowance for overtravel
F = Feed-inches per min.
K1 = Rate of carriage return
K2 = Rate of indexing
T = Number of teeth in gear
Pitch of Gear
Length of Cut
Pivot
Feed-Inches Per Min.
Pivot
Number of Teeth in Gear
Total Time, Minutes
Correction for indexing
0-24 teeth: add 1 unit:
25-49 teeth: add ½ unit:
50-up teeth: add ¼ unit:
This chart automatically corrects for cutter approach and overtravel

who operated a gear hobber. It should be noted in using the chart for finding the cutting time, Fig. 10, that the chart automatically takes care of the cutter approach. This is possible because depth of cut and diameter of cutter are determined by the pitch of the gear when standard cutters are used.

As each group of standards is completed, it is turned over to the planning clerk for use. Such groups can immediately be put on premium time, with resulting economies.

The speed with which these methods may be introduced throughout the plant depends largely on the timestudy engineer to whom the work is entrusted. If the engineer is a trained manufacturing analyst, with a thorough knowledge of modern methods and tooling, he will bring to the work a background of experience that will enable him to establish standard conditions in a minimum of time.

The development of data for hand-operated machines and manual operations will require more time for the establishment of the more desirable conditions because of the greater number of variables affecting quality and production. Here, the engineer's experience will be of greater importance in speeding the work and in preparing the planning standard from the analyses and time-studies. It should be the aim of the engineer to establish as nearly as possible ideal conditions surrounding the performance of the work in each class. This will remove any temptation to cut rates since the rates will have been set as close as is practical, at the beginning.

The author recommends that the use of the data contained in the foregoing pages be preceded with an adequate check against existing conditions. Requirements of finish, accuracy, materials and methods differ greatly in various plants, and all of these factors affect time and production. The chief object of this article is to point out the economies to be effected by the use of the methods presented and the general course of procedure to be followed.

Correction: In Article I of this series, the second sub-head of Table I (Vol. 77—page 422) should read "Feed Two cuts—One setting."

Modern Alchemy at the Golden Gate

Alchemists of ye olden days wasted a lot of time trying to turn base metals into gold, and they probably had a lot of fun trying. But there's evidently a real alchemist loose on the coast of sunny California—at least he got away with it for a while and left several San Francisco jewelers holding the bag.

A detective brought the assayer some beautiful pieces of white gold, about 1x2½ in. and a quarter inch thick. They had a lustre that would have added adornment to any fair damsel if small slabs had been in fashion for brooches or pendants. They had been gathered from various jewelers around the Golden Gate who had bought them at bargain prices, but not before they had tested them with acid in the good old way and knew what they were buying. The seller had promised to keep them supplied but had evidently had an attack of amnesia, hence their suspicion.

Then the assayer got busy. The blocks were common stainless steel!

Hysteresis in Springs

ROBERT W. CARSON

In applications where spring deflections must be controlled within a few per cent elastic hysteresis, a time lag of strain in relation to stress may present a serious problem. The factors controlling hysteresis, and the relative hysteresis of several spring materials are given. Design considerations and heat treatments minimizing the effect of hysteresis are recommended.

ROBERT HOOKE, who had much to do with the early development of springs, gave the world the well known Hooke's Law more than 250 years ago when he wrote "ut tensio sic vis." In modern terms this is "the deformation varies with the force," that is, the strain is proportional to the stress. As greater accuracy and increased sensitivity have been built into springs certain deviations from this simple relation have been found. One of these deviations, elastic hysteresis, is a lag of strain in relation to stress. If the elastic portion of a stress-strain curve is determined with sufficient accuracy, the ascending and descending lines form closed loops shown in Fig. 1.

One of the first reported investigations of elastic hysteresis was made by Lord Kelvin in 1865. He used a wire of spring material as a torsional pendulum, and determined the energy lost in hysteresis (area inside hysteresis loop) by measuring the decrement or decrease in amplitude. Several scientific investigations using this same method have been reported in recent years. Elastic hysteresis has also been measured in connection with fatigue testing. The Bureau of Standards has made a study of elastic hysteresis in spring materials used in altimeters, and the A.S.M.E. Research Committee on Mechanical Springs has sponsored a study including the effect of elastic hysteresis in spring materials. There have been a few meager reports from precision spring manufacturers indicating that they use special processes to reduce the effect of hysteresis. References including these reports are listed on the next page.

At present two types of elastic hysteresis are well defined. The first type, statical hysteresis, is independent of the time of loading and forms a thin hysteresis loop as illustrated in Fig. 1. This effect, also termed internal friction, damping capacity, dynamic ductility, appears to be a property of the molecular structure of the material. The damping of vibrations in tuning forks and bells is due to the energy absorbed by statical hysteresis. Kimball and Lovell in reporting their investigation list some spring materials in the following order of increasing hysteresis: cold worked phosphor bronze, rolled monel, 3½ per cent nickel steel, rolled nickel, cold rolled medium steel, rolled copper, cold rolled brass. Von HeydeKampf lists in the same order the following materials: chrome-vanadium steel, chrome-nickel steel, brass, carbon steel.

Von HeydeKampf reports that the statical hysteresis for a 1 per cent carbon steel worked at a maximum torsional fiber stress of 20,000 lb. per sq.in. is approximately 4 per cent of the load deflection, while the chrome-vanadium steel under the same conditions shows a hysteresis of 0.2 per cent.

Investigators agree that the amount of statical hysteresis increases rapidly as the working stress is increased as shown in Fig. 2. In general it is found that doubling the stress increases the statical hysteresis to three times the original amount. It is apparent then, that under conditions where a very close proportionality between load and deflection is required a spring material such as phosphor bronze or alloy steel must be selected, and the spring must be designed for low working stresses.

On the other hand, occasions may arise where a large amount of statical hysteresis may be useful in absorbing vibration. Under these conditions a spring material such as brass or carbon steel must be selected and the spring de signed for high working stresses.

The second type of elastic hysteresis, generally termed hereditary hysteresis, is a retardation or time lag of the spring deflection under a steady load or after removal of a steady load. The deflection of the spring continues to increase or drift as long as a steady load is maintained. When the load is removed a similar effect, recovery, takes place as the spring slowly approaches its former unloaded position. Fig. 3 illustrates the creep and recovery action measured by MacGahan and Carson on phosphor bronze ribbon. Under a steady pull, such as gravity loading, the spring will increase in deflection. When the spring deflection is fixed as in the case of a spring compressed to a fixed length the creep tends to reduce the load on the spring.

The magnitude of the hereditary hysteresis depends on the working conditions, the physical condition of the spring material, and the previous history of the spring, and under certain conditions may introduce variations of several per cent in the spring load or deflection. Working conditions which influence the amount of hereditary hysteresis are duration of load, working stress, and temperature of the spring. The creep continues with time at a decreasing logarithmic rate as shown in Fig. 3. This curve shows that one-fourth of the creep measured in 24 hours took place during the first hour and that recovery likewise proceeded at a decreasing rate. As the working stress

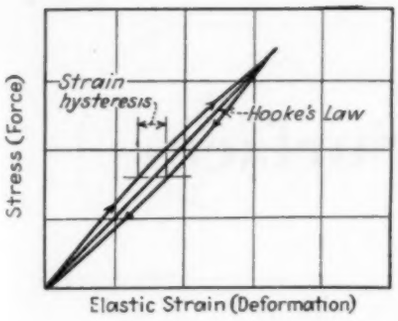


Fig. 1—Typical elastic hysteresis loop

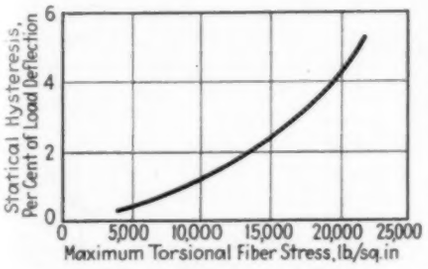


Fig. 2—Statical hysteresis in 1 per cent carbon steel (From Von HeydeKampf)

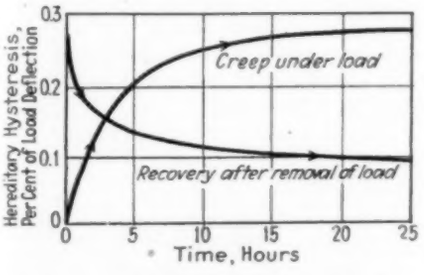


Fig. 3—Hereditary hysteresis in phosphor bronze (From MacGahan and Carson). Specimen—6 in. length of 0.014 by 0.145-in. ribbon. Stress relief anneal—300 deg. C., 15 min. Loaded in bending—maximum fiber stress, 12,000 lb. per sq.in.

is increased the rate of creep and recovery increases, and an increasing amount of permanent set is found as the elastic limit is approached. Increasing the working temperature has the effect of lowering the elastic limit of spring materials, and consequently increasing the amount of creep, recovery and permanent set.

The physical condition of the spring material has probably the greatest effect on hereditary hysteresis. Internal stresses introduced in cold working, cold forming, or cold bending of the material may increase the hysteresis of the material by 10 to 100 times unless the internal stresses are relieved by a low temperature anneal. St. Clair states that a large crystal structure, presumably obtained by annealing, produces much greater hysteresis than a fine grained structure. Also, Chevanard has shown that brass has less hysteresis than either copper or zinc alone.

The previous history of the spring also has a large effect on hereditary hysteresis. It is this effect which led to the use of the term "hereditary" in describing this type of hysteresis. It has been found that the effect of hereditary hysteresis can be temporarily removed by exercising or repeated loading of the spring. The effect of this treatment is to superimpose a number of different creep and recovery actions so that the total effect is negligible. However, this remedy is only temporary, and after sufficient rest the normal hereditary hysteresis will again appear. Exercising offers a very useful method of separating statical and hereditary hysteresis effects.

Under Steady Loads

Under conditions of steady load where it is desirable to control hereditary hysteresis, working stresses of not more than 20 per cent of the elastic limit should be used. Under working conditions where an elevated temperature is met careful attention must be given to the lowering of the elastic limit under these temperature conditions. After all forming or shaping operations are performed the spring must be given a careful stress relief anneal. The aging heat treatment given in a previous article (Vol. 77, No. 6, page 202) is recommended for this stress relief anneal.

In such applications as speedometer springs, instrument springs, weighing springs, altimeter diaphragms and bourdon gage tubes, where a high degree of accuracy is required, the spring material should be chosen with due regard to its inherent statical hysteresis, working stresses must be kept to less than 20 per cent of the elastic limit at the operating temperature, and the finished spring must be given a careful stress relief anneal. Springs with elastic defects less than 0.1 per cent of the load deflection can be produced if careful attention is given to each of these suggestions.

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Wear of Hard Metallic Surfaces

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A new method of wear measurement is presented and compared with previous tests

IN ENGINEERING, wear is defined as reduction of the original dimensions caused by separation or dislocation of particles of the surface. This is distinct from dimensional changes caused by heat, elasticity, internal changes of structure or fatigue. Wear generally consists of two phenomena: dislocation and extrusion of the particles beyond the original surface, and their separation afterward.

Brinell hardness and toughness have undoubtedly an important influence on wear. Great hardness, as manifested by the impression of a steel ball or diamond point, is a proof of the great resistance of the material against penetration, scratching or dislocation of surface particles. On the other hand; toughness has the tendency to reduce wear by making the separation of particles more difficult.

As a rule, resistance against wear does not depend alone on the strength of the material nor on its hardness as determined by some commonly used method as the Brinell or Shore. Determination of hardness, therefore, is not sufficient to disclose the resistance of the material against wear.

Other factors having an essential influence on wear are metallographic constitution and homogeneity of the material, as well as pressure and speed of friction, travel, lubrication and initial smoothness of wearing surface. The principal cause of wear is rolling or sliding friction with or without lubrication.

After having investigated for many years the wear of gages and tools and various wear test methods, I have reached the conclusion that a rotating disk is eminently suitable for such tests. The advantage lies in the speed and ease of the test and in the possibility of performing it on the work without damage. A machine (Fig. 2) developed for wear tests has a rotating disk made of tungsten carbide pressed directly against the work which is subject to insignificant wear.

As shown in Fig. 1, the tungsten carbide disk *A* is supported on two bearings, connected by a yoke *B*. The weight *F* acts on this yoke through lever *D*, which swivels around fulcrum *E*, and rod *C*, which slides in bushings *G* and *H*. The disk is driven by a motor, located in the base, through pulley *K* and flexible shaft *J*. The work tested is cooled by a stream of suitable liquid, which also carries away the metal dust. A universal vise, capable of vertical displacement, holds the work.

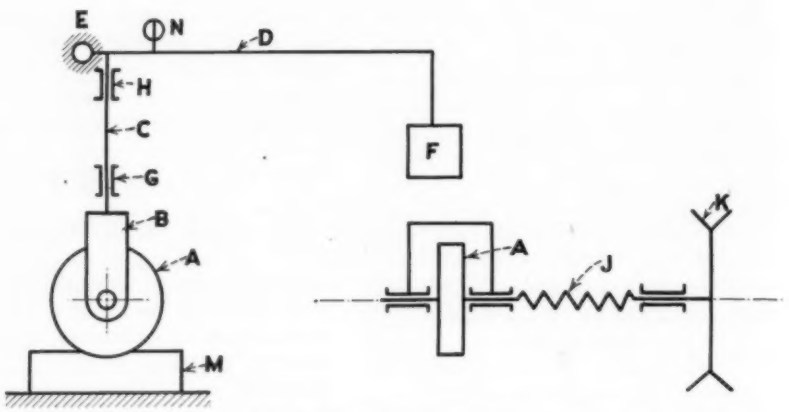


Fig. 1—Wear is tested by a revolving tungsten-carbide disk using a powerful stream of liquid to cool the disk and test piece

By means of a spirit level, the work is placed so as to present a horizontal surface to the edge of the disk, or two horizontal tangents at right angles, if the surface should be curved. By looking through the gap between the work and the disk, it is possible to check the parallelism of the surface with the disk. The vise is moved up carefully until the work contacts lightly with the disk and the hand of the depth gage, located on top of the machine, points to zero. The loaded lever is now horizontal. The motor is started; the depth gage makes it possible to follow the penetration of the disk, and a counter keeps track of the revolutions.

After a specified number of revolutions, the machine is stopped and the reading of the depth gage *N* is noted. The microscope, located on the left side of the frame work, is swung over the impression; a sliding shutter in the microscope makes it possible to measure the width *A* of the impression (Fig. 3) in

Fig. 2—The Skoda-Sawin machine makes it possible to evaluate wear resistance in terms of volume of the impression

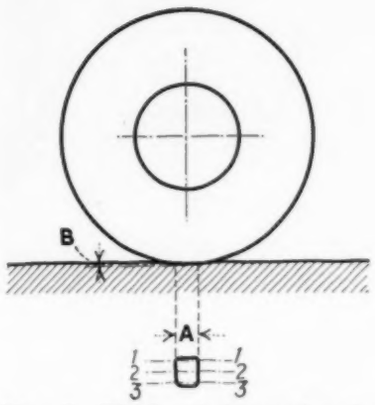


Fig. 3—Width of impression is measured at three points and the calculated depth checked against the depth gage reading

three different positions. The corresponding depth B in 1/1000 mm. is determined from a table. If this figure agrees with the reading of the depth gage, the same table is used to find the volume of the impression in 10^{-3} mm.^{3}, which figure is considered a measure of wear.

Considering the dimensions of the tungsten carbide disk as constant, the impression could be sufficiently defined by its width and depth. However, it is the volume of the impression which should be considered as measure of wear.

To obtain an impression with a sharply defined edge, a small flat and smooth surface, parallel to the axis of the disk, should be provided on the test piece.

For purposes of comparison, the impressions should possess geometrical similarity, which is not the case. In machines used for shop inspection of hard surfaces and for checking the effects of the heat-treatments of alloys, the deviation from geometrical similarity may be neglected. The hardness of heterogeneous materials would have to be compared by the total number of revolutions required to obtain the same impression, and even then, different pressures would have to be applied. The results would have to be reduced by experiment to a common basis.

It may be surmised that the chips produced in this machine are approximately of the same shape and size, and according to Rittinger's law, the volumes of the impressions are in direct ratio to energy expended, that is, to the product of pressure and the number of revolutions.

Checking for Accuracy

The reliability of the machine may be ascertained by:

1. Analyzing all the possible errors accompanying a test,

2. By carrying out a series of tests on standard test pieces and analyzing their variation, and

3. By comparing the results of this machine with the results on other machines and actual shop performance.

Analysis of Errors

Errors, partly estimated, partly measured, are caused by:

1. Dislocation of axis after grinding the disk, plus or minus 40 micron per 1 mm. of width, that is, plus or minus 4 per cent.

2. Irregular flow of coolant and its chemical changes, plus or minus 25 micron or 2.5 per cent.

3. Unequal smoothness of the test piece, plus or minus 10 micron or 1 per cent.

4. Irregularity of the scale of the microscope plus or minus 2.75 micron or 0.275 per cent.

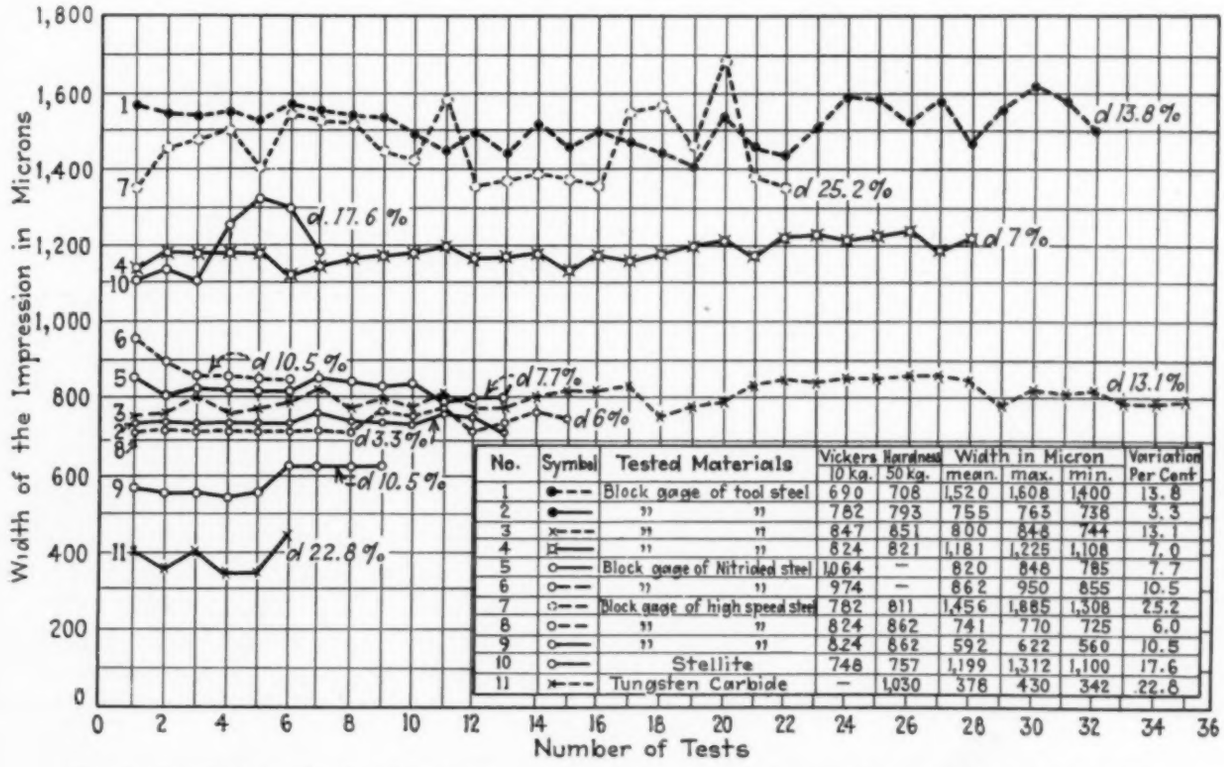
5. Observation errors (average of two observers), plus or minus 5 micron or 0.5 per cent.

6. Irregularities in the running of the machine, as for instance drive of the disk, plus or minus 7 micron or 0.7 per cent.

The calculus of probabilities fixes the maximum error at:

$\sqrt{4^2 + 3^2 + 1^2 + 0.275^2 + 0.5^2 + 0.7^2} = 5$ per cent per millimeter of width of impression. As the average width of impression does not exceed 1 mm. it may be claimed that the machine guarantees results within —5 and +5 per cent, that is, about the same as existing apparatus for hardness tests.

The material for standard test pieces should be uniform over all its surface, yet hardness tests have failed to discover such a material. Of the tested



No.	Symbol	Tested Materials	Vickers Hardness 10 kg.	Vickers Hardness 50 kg.	Width in Micron mean.	Width in Micron max.	Width in Micron min.	Variation Per Cent
1	●---	Block gage of tool steel	690	708	1,520	1,608	1,400	13.8
2	●—	" "	782	793	755	763	738	3.3
3	×---	" "	847	851	800	848	744	13.1
4	×—	" "	824	821	1,181	1,225	1,108	7.0
5	○—	Block gage of Nitrided steel	1,064	—	820	848	785	7.7
6	○—	" "	974	—	862	950	855	10.5
7	○---	Block gage of high speed steel	782	811	1,456	1,885	1,308	25.2
8	○--	" "	824	862	741	770	725	6.0
9	○—	" "	824	862	592	622	560	10.5
10	○—	Stellite	748	757	1,199	1,312	1,100	17.6
11	×---	Tungsten Carbide	—	1,030	378	430	342	22.6

Fig. 4—Standard test blocks of various materials were used to determine the variation of the readings

materials, namely, steel block gages of different manufacture, high-speed steel, nitrided and chromium plated alloy steels, Stellite and tungsten carbide, the best results have been shown by block gages, as shown in Fig. 4. From Curves 1 to 6 it is evident that the variation in tests is no greater than that carried by errors of the machine. High-speed steel, Stellite and tungsten carbide did not possess a sufficient uniformity to be used as standards. The difference in average width of impression is partly caused by different resistance to wear and partly by differences of test conditions such as coolant, duration, circumferential speed of the disk and pressure.

Comparison of Tests Obtained on Different Machines

To find whether the machine is suitable for tests on plug gages, which actually operate under different conditions, plug gages 50 mm. in diameter were made, one of supereutectic steel, heated, to 780 deg. C., hardened in water and tempered at 150 deg. C., the other of a special aluminum alloy steel nitrided. The hardness of the first was 873 Vickers and of the second 841. They were tested first on the Skoda-Sawin machine and then on a device originated by French and Hershmann, Fig. 5.

The plug gage *K* under test was subject to a reciprocating movement, while the two-piece cast iron bushing *P* was oscillating around a vertical axis. The pressure between the plug gage and the bushings was adjusted by means of springs. The number of strokes and consequently the total travel was registered by a counter. The wear was ascertained by measuring the diameter of the worn gage in six places. The same coolant was used in both tests.

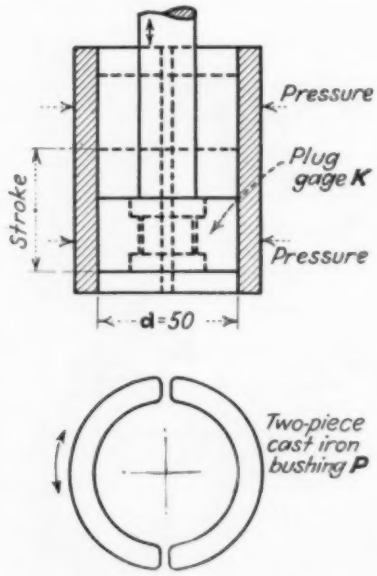


Fig. 5—French and Hershmann test method was described in "Wear of Steels with Particular Reference to Plug Gages" Trans. of the A.S.S.T., November, 1926, and "Recent Experiments Relating to the Wear of Plug Gages," 1927

The ratio of wear between the nitrided steel and tool steel was as follows:

After a travel of 6.5 km.—1:2.9
After a travel of 9 km.—1:3.4
After a travel of 10.5 km.—1:3.7
After a travel of 13 km.—1:3.9
After a travel of 17 km.—1:3.2

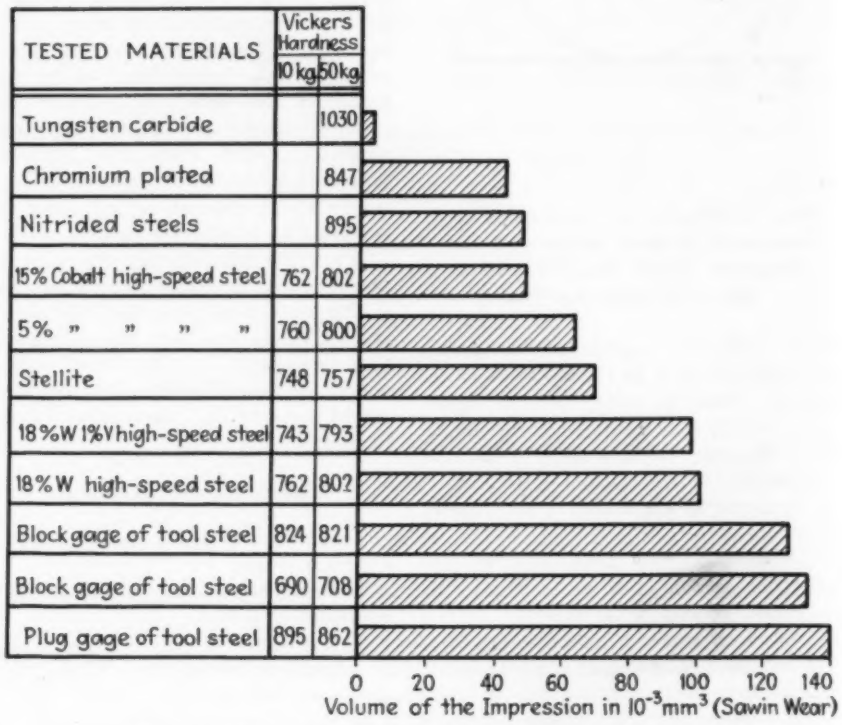
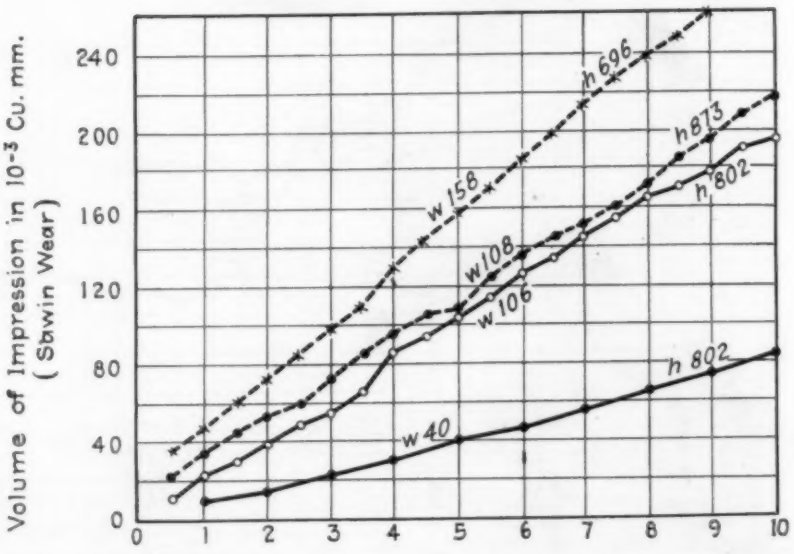

TESTED MATERIALS
Vickers Hardness
10 kg.
50kg.
Tungsten carbide 1030
Chromium plated 847
Nitrided steels 895
15% Cobalt high-speed steel 762 802
5% " " " " 760 800
Stellite 748 757
18%W 1%V high-speed steel 743 793
18%W high-speed steel 762 802
Block gage of tool steel 824 821
Block gage of tool steel 690 708
Plug gage of tool steel 895 862
0 20 40 60 80 100 120 140
Volume of the Impression in 10^{-3}mm^3 (Sawin Wear)

Fig. 6—The wear of different materials and their Vickers hardness is shown graphically



Test No.	Symbol	Block Gage	Vickers Hardness 10 kg.	Vickers Hardness 50 kg	Sawin Wear
1	×— —	20 mm. carbon tool steel	690	696	158
2	•— —	20 " " " "	847	873	108
3	o——	17 " " " "	762	802	106
4	•——	20 mm. 18% tungsten steel	762	802	40

Fig. 7—A comparison of wear and hardness numbers shows that the two check only for the same material

with the average travel of 11.2 km. corresponding to a ratio of 1:3.4.

The same plug gages tested on the Skoda-Sawin machine produced a ratio of 1:3.1, which is a close approximation to this figure. The same difference in wear has been confirmed by shop use.

Results of Wear Tests on Different Materials

As far as wear is concerned, all metallic materials possessing hard surfaces may be divided into four classes:

I. Tungsten, tantalum, and molybdenum carbides.

II. Nitrided and chromium plated alloy steels, special cobalt steels with 5-15 per cent cobalt, capable of being hardened, hard alloys and Stellite.

III. Hardened high speed steels, such as 18 per cent tungsten steel, special steels with a higher content of tungsten or with a content of vanadium, molybdenum, cobalt, etc.

IV. Hardened tool and case-hardening steels.

The ratio of wear for these groups could be expressed by the following mean values:

I : II : III : IV = 1 : 15 : 25 : 40

Gages surfaced with tungsten-carbide had 1/40 of the wear of tool steel gages subject to a standard heat-treatment.

Fig. 6 shows the wear of different materials under the same conditions. The wear of tungsten carbide is insignificant. Chromium plated and nitrided steels show the same wear as 15 per cent cobalt high speed steel subjected to the customary heat-treatment. The wear increases when the cobalt content drops to 5 per cent. Wear of Stellite was slightly higher than that of 5 per cent cobalt high speed steel. The wear of carbon tool steel was considerably higher than that of high speed steel. The difference in wear of plug gages of carbon tool steel and Johansson blocks was not large.

The comparison of these results with those of French and Hershmann and Nieberding is rather interesting. French and Hershmann give the wear in milligrams.

	French and Hershmann	Nieberding	Sawin
Hardened tool steel....	100	100	100
18% tungsten high-speed steel.....	84	57	72
Stellite.....	71	81	50
Nitrided steel.....	49	45	34
Chromium plated steel.	29	5	32
Tungsten-Carbide.....	..	0	2.5-3

The great difference in Nieberding's results with chromium plated steels may be caused mainly by the difference in thickness and method of plating. The same applies to nitrided steels.

The Stellite investigated was of different manufacture and not uniform.

Relation Between Wear and Hardness

French and Hershmann have shown that plug gages of 1.0 per cent carbon steel, with a Rockwell hardness of C 56 to C 59 have greater resistance to wear than gages hardened to C 63 to C 66. This difference is even greater with oil hardening steels (0.86 C, 1.17 Mn, 0.5 Cr, 0.41 W). Nieberding's wear tests of tool steel tempered to 700 deg. C. in steps of 50 to 100 deg. C. have shown that its resistance to wear increases gradually though slightly from 120 to 400 deg. C., while the hardness drops. At a further increase of the tempering temperature, the resistance to wear decreases at the same rate as the hardness. These conclusions agree with the results of French and Hershmann. Although Nieberding found that tool steels resist wear better when tempered at 400 deg. C., he recommends tempering at 200 deg. C. to preserve surface hardness.

Our tests with tool steel have shown that an increase of the tempering temperature from 100 deg. to 400 deg. C. reduces both resistance to wear and hardness; the highest Vickers hardness of 875, obtained at 100 deg. C., corresponds to the highest resistance to wear 82. Within the range 220 to 280 deg. C., the resistance to wear is almost constant (121 to 124), while the hardness drops from 750 to 600. Annealed steel shows the same wear as steel tempered at 400 deg. C.

Another series of tests with tool steel, using a solution of sodium carbonate as coolant in the machine, has shown the minimum wear when the steel has been tempered at 300 deg. C.

Fig. 7 shows the wear of different gage blocks. These gage blocks were made of steel of approximately identical chemical analysis but of different hardness. The softest had the greatest wear. A gage block made of 18 per cent tungsten steel had the highest resistance to wear, although possessing the same hardness as a tool steel gage block.

In conformity with other investigators it may be claimed that only when materials of equal chemical analysis and identical heat-treatment are compared, hardness may be considered as a sign of resistance to wear. It is not possible to judge the resistance to wear of essentially different materials by their hardness numbers.

How Not To Run a Plant

Wherein a workman takes a fall out of a four-flushing efficiency expert

I AM A WORKMAN, and I have read many articles written by executives on the management, handling and peculiarities of employees. Let us now turn the miscroscope around and discover what the workman thinks of some executives.

Not so long ago there was a company that designed and built special production machinery, such as machines to load, seal, count and wrap packages. Designing mechanisms of this type requires plenty of brains, time, quietness and peace. The manager was square-dealing, well educated and experienced. He saw that the above essentials were provided and especially the brains, for he invited every man in the plant to make any suggestion he wished, and if it was adopted that man received real compensation for the idea. This scheme worked to perfection, and while each special machine was probably the consolidation of ideas supplied by Tom, Dick and Harry, the chief designer would whip the hodge-podge into a nice stream-lined model, so to speak, and the customer was well pleased in spite of the stiff price.

Then an evil day arrived when the manager was threatened with a serious illness and had to go to another climate for almost a year. The president stepped in to fill the gap, but unfortunately he had never taken any interest in what he termed "ordinary routine work". His brain, he thought, was too valuable for such plebeian operations, and so he had saved it for that important factor of modern business, meeting other high executives of concerns that were potential customers. This involved trips to Cuba, Atlantic City and Florida, which were mixed up with considerable golf. The president soon discovered that sitting in a chair all day and acting as caliph over a thousand and one problems was too much for his nervous system, so he looked around for some way out.

About this time an efficiency expert who was out of a job got wind of things and thought he saw an opening.

He was pompous, precise and carried a split-second stop watch. He called and for several hours talked to the president-manager about production units, differential gains, task bonus systems, employees' incentive and other high sounding terms, and finally convinced his bewildered listener that the plant was utterly out of date, that it was but little better than a museum of antiquities, and thus was doomed. Next he went on to explain that if he could be permitted to whip it into shape and systematize it the profits would become astounding. The efficiency expert was a super high-pressure salesman (for himself) and was promptly hired at fifty dollars a day which was five thousand a year better than the old manager rated.

Keeping Out Ideas

The "reconstruction" started the next day, and about the first thing the expert did was to put a "No Admittance" sign on the outside of the door leading to the designing room and a "No Smoking" sign on the inside. After this designers were to design and, furthermore, were told to stay at their boards. Foremen, toolmakers, and Tom, Dick, and Harry were also instructed to attend to straight production and any further suggestions on knot-tying mechanisms or compensated cam actions were "Verboten". The designers were to worry about all those complex details, for that was exactly what they were hired and paid for, and if they could not make the grade, there were "hundreds of others clamoring at the gate" who could.

The next action was the arrival of a flock of timestudy men who, armed with stop watches and clip boards, trailed the machinists and toolmakers around. They counted their steps, the number of drinks, the trips to the toolroom and toilet and got ready to swing every job to a piece rate in short order.

The toolroom foreman tried to explain to the new executive that a piece-rate system was applicable only to shops where they had a steady production of similar pieces, like pipe fittings for example, and that, in his twenty years experience with the firm, the biggest order they had ever received for any one machine was for twelve. The foreman meant well, but the efficiency expert told him that he belonged in the toolroom where he probably understood how to make tools, but attempting to discuss production methods with experts was not what he had been hired for.

Inside of three months the plant was operating on some kind of a task-bonus incentive plan that none of the men could understand, nor could any of them even make a decent guess at what their weekly pay envelope would contain except that it would surely be less than they expected. The various special machines, that had previously had all their troubles and difficulties overcome, progressed through the shop at an undoubted reduction in the usual prime labor cost, that is, if the various new piece-rate men, cost keepers, checkers and inspectors were not charged against the job; otherwise, they actually cost more.

About this time the "War Lord", as the expert was now called, discovered that the machine development work was lagging. Wear errors had developed in accumulating instead of compensating effects. Cam actions required still more revision. Pasting devices had acquired a habit of gumming up and failing to deliver the paste, with the result that the cartons would fall open and spill their contents among the gearing and produce a glorious mess. All these things and more had to be overcome. The expert, of course, knew nothing but "system" and that did not help when there were only three men—the chief designer and his two assistants—to do it all. There simply were not sufficient brains available to handle the load.

The efficiency expert tried to cure this by hiring a bunch of draftsmen who were "clamoring at the gate"; the result was strictly nil, for this kind of work called for men who had had considerable experience—an item which the "War Lard" did not know.

Designing by Schedule

To force the designing, the efficiency expert now took drastic measures; he fired the two principal assistants as a warning to the rest and told the chief designer that if he did not get a set of plans out in the next seventy hours he would be demoted and someone more capable put in his place.

That evening the chief designer went to the home of the president and explained that business simply could not continue the way it was headed. That complacent individual, however, had just read the latest production cost summary and had concluded that the efficiency expert was a heaven-sent gift. Therefore he told the chief designer, rather emphatically, that if he had any complaint to make it would have to be made direct to the acting manager since he was in charge of the factory.

About this time the efficiency expert must have realized that things were headed for a grand crash, a fact that practically everyone in the plant had figured out two months before, but his remarkable facility for making encouraging reports combined with his fluent tongue continued to hypnotize the president and executives into the belief that they were now launched in a high speed, high efficiency, high profit system and headed for amazing prosperity.

It was during this seething that the old manager returned, once more in good health and in possession of his customary vigor. It happened to be early in the evening when he arrived, so he made a few calls to see how the boys were, and after he had made short visits with the chief designer, the toolroom foreman, the storeroom keeper and the old blacksmith, he knew plenty. He discovered so much that by the following noon he had fired the "expert", had thrown all the "From this date no employee . . ." notices into the furnace and had started to restore confidence and equanimity. It took him several years to get the organization back to its smooth running basis again.

Assembly Notes on Drawings

Discussion

HEINRICH KAFFINE

The article by William H. Kellogg under the title given above (*AM*—Vol. 77, page 343) gives me an opportunity to report another method.

On our drawings we always mark the symbol number of the supplementary part directly on the place where it is to be put in assembling the machine. For instance, along every finished surface and opposite to every hole (provided it is not a tapped hole for a commercial screw, we mark the symbol number of the part to be assembled.

For example: $\frac{\text{⅞ in. drill — ½ in. ream}}{\text{for H-2906}}$

By following this method it is not necessary to provide extra space on the drawing for assembly notes, and, furthermore, we eliminate for the man in the shop both the time and the effort in finding out to which surfaces or holes belong the various parts in the assembly list.

A Magnetic Block

Discussion

FRANK HEWITT
Liverpool, England

With reference to the article under the title given above by Charles F. Kraut (*AM*—Vol. 77, page 189), my personal experience with such a magnetic block as he describes has proved to me its inability to hold work securely. The magnetism transmitted is so slight as to be ineffective. This conclusion is based on thorough tests and would point to the reason for the apparent obscurity of these, so called, magnetic blocks.

EDITORIALS

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After NRA What?

The childlike faith in Gen. Johnson and his aides displayed by certain industrial groups that have gone to Washington and tried to unload all their troubles is truly touching. But their lack of business judgment in surrendering complete control of their affairs to government is disturbing. What happens after the deputies drafted by NRA return to their jobs and bureaucrats take over the controls—if that should happen to be the outcome of the great experiment?

It may be charitable to believe that these men are so dazed by the misfortunes of the past three years that their action is excusable, but it is hardly a tribute to their judgment as leaders. Many of us resented the accusation of Donald Richberg that industry was largely to blame for the depression, but if we have a few more such examples of executive futility we shall be hard put to it to find arguments to confute him.

No one of us knows what will happen two years from now when the NIRA expires by limitation. It may be continued in force, it may be modified to make it stronger or weaker, or it may be allowed to lapse. The part of discretion is to take advantage of the opportunity given by the Act to each industry to set its house in order, and to enlist NRA help in so doing. It is equally important to hold on to the freedom from bureaucratic domination that is essential to future growth.

Prices of Spare Parts

Prices of spare parts have long been a serious problem for both makers and users of machines. Makers often claim to lose money on spare parts business and users are equally sure that the prices charged are far too high. Is it possible that both are right?

It can hardly be doubted that the maker of the machines can make the parts for less money than a small shop with less efficient equipment. It is equally certain that many small shops can handle part orders at lower cost than is now done in some of the large plants. The many small shops that make a profit in supplying spare automotive parts are evidence of this. Pistons, axles, connecting rods and other parts are made in many small plants and sold at a lower price than by the factory, and at a profit.

There was a time when independent parts makers, commonly known as "gyps" by the larger makers, may have used inferior material in their product. The continued success of some replacement parts makers kills the charge of poor material. You can't fool all the people all the time. The successful parts makers have learned to select material at least equal to that used in the original part as the price of survival.

Few customers appreciate the cost of handling a small order in a large plant. And when they can buy the same part for less money from a small shop naturally they feel that the large shop prices are exorbitant. The maker's cost of storage, inventory and accounting is not for the customer to worry about, especially when he can buy parts at lower prices elsewhere.

Replacement parts at reasonable prices are important to both maker and user. If the maker cannot get his total costs down to that of the small shop, he cannot expect to hold the business. Perhaps the spare parts work can be organized on the small shop basis, cutting out a lot of overhead. The maker who wishes to keep his spare parts business should at least consider this possibility.

Play Ball with NRA

Don't misunderstand the real aims of NRA. First and foremost comes the grim determination to get men back to work at wages that will support them and their families. Every man connected with the organization in Washington, from the President down, is willing to play ball and expects employers to play ball, too.

Hardly less urgent is the demand for speed. Every possible means has been taken to impress this need on the whole country. The latest one is the so-called blanket code, which is not a code at all but an agreement with the President that depends on patriotism and public sentiment for enforcement. If you don't like this type of moral suasion—objections to it have been voiced in leading newspapers—the thing to do is to avoid it by getting your own industry code drawn up and adopted, at once.

The NRA officials have shown their willingness to play ball with industries that have endeavored to act according to the spirit of the law. But don't expect that attitude from them if you try to take advantage of technicalities. 1929 standards may be fair for some industries as a code basis, but utterly unfair for others. Remember that there were several million unemployed even in 1929, and that wages in more than one industry were entirely too low. You may expect generous treatment on trade practice stipulations if you set up wage and hour limits that are in line with current needs —not otherwise.

In your own interest get under a code as quickly as possible. Every day of delay strengthens the story of the union organizer who is telling your men that their only chance for a square deal is to sign up with the union. Once a code is adopted no union can do any more for a workman than the administrator who is in touch with its working.

There is only one answer to your present worries. Play ball—with your men, with your customers, with your suppliers, with NRA. You won't regret it.

CHIPS

Washington—President releases blanket code in endeavor to lift purchasing power during period of hearings on industry codes . . . Meets with encouraging response from business and industry, unfavorable criticism from certain newspapers and economists . . . Industrial groups rush codes to avoid more severe requirements . . . Hearings begin on steel code, continue on electrical and shipbuilding codes . . . NRA will prescribe oil code on appeal of industry groups unable to agree . . . Navy opens bids on 21 ships . . . Bethlehem low on heavy cruiser, Newport News on two aircraft carriers, New York Ship on two light cruisers . . . 32-hour week likely on these contracts . . . Sec. Wallace announces quotas for wheat production in various states . . . Gen. Johnson goes to Detroit to talk turkey with automobile leaders . . . Brings back code draft for open-shop 35-hour week, 40 to 43 cents minimum wage . . . Mr. Ford still thinking about it . . . First bulletin issued explaining intricacies of blanket agreements . . . Sec. Perkins visits steel mills to get information for steel code hearings where labor problem will be uppermost.

Foreign—Japan stages mimic air raid over Tokio to gain public support of huge war budget . . . France plans lottery to raise funds after ten-year loan fails . . . World Economic Congress recesses . . . England moves to divorce sterling from gold bloc and dollar . . . British Commonwealth of Nations agrees on uniform fiscal policy . . . Eight nations sign agreement under which silver holding countries limit sales, silver producers will absorb share of production . . . Mussolini takes over war portfolio in move taken to indicate concentration of land, sea and air forces . . . France suggests swapping American wine markets for lower tariff on wheat . . . Establishes new high tariffs ostensibly aimed at Germany but actually restricting imports from U. S. much more drastically . . . Withdraws them on suggestion that wines might be barred here . . . Italian fleet of 24 planes visits Chicago and New York and leaves for home amid plaudits of U. S. . . . Hitler announces withdrawal of political overseers from factories.

Finance—Calls for higher margins on stocks, particularly "wet" stocks, one cause of abrupt recession . . . P.R.R. reduces $27,000,000 R.F.C. loan to $5,000,000 . . . N.Y.C. cuts salaries as prerequisite to plea for lowering of R.F.C. interest rate . . . $10,000,000 returned to railroads as result of recapture clause repeal . . . Federal Reserve reduces open market operations as currency continues to return to banks . . . British conversion offer on 5½ per cent gold dollar bonds taken as move to keep pound below dollar parity . . . Bank clearings 33 per cent above 1932 week . . . Financial interests behind B. & O. and P.R.R. rumored to be talking about merger of properties . . . Denied by Willard . . . Treasury floats issues of $500,000,000 in 8-year 3¼ per cent bonds and $350,000,000 in 2-year 1⅞ per cent notes.

Industry—Chevrolet recalls 8,000 more . . . B. & O. puts 500 more carmen back . . . Bureau of Labor Statistics reports June employment up 14 per cent over March, payrolls up 29 per cent . . . Labor leaders expect ranks of unions to return to 5,000,000 peak of 1918 as NIRA takes effect . . . Company unions growing also . . . Chrysler shortens hours, raises pay of 45,000 . . . Chevrolet, Buick, G. M. Truck and Pontiac raise wages 15 per cent . . . Sec. Perkins working for code to abolish competition of prison-made products . . . General Motors reports earnings in second quarter of 90 cents a share as compared with 7 cents last year . . . Many industrial companies reporting on first half of 1933 show great improvement in earnings . . . Union labor organizers make plans for "Federal" unions in mass production industries . . . Lehigh Valley shops go from 3 to 4 days a week . . . N. Y. Central puts on 1,475 more men in 16 car and locomotive shops of system . . . New Departure raises wages, and salaries under $1,800, 10 per cent.

Trade—G. E. second quarter up 1 per cent from 1932 second quarter . . . World-wide boycott of German goods voted by Jewish delegates at Amsterdam conference . . . Grain trade on orders from Washington resulting from speculative collapse sets up trading rules to prevent recurrence . . . State governors join in asking U. S. to press war on racketeers . . . Auto tire prices raised third time since May.

Indicators—Steel production drops back a point as light industries slow down but scrap prices rise to new highs . . . Electrical energy output gains 14.5 per cent over corresponding week of 1932 . . . Stocks and commodities continue recovery after shake-out . . . All wheat deliveries again above one dollar . . . Dollar strengthens in foreign exchange markets . . . Copper steady at 9 cents . . . Carloadings up to 1931 level . . . *Business Week* index up slightly to 69.8.

President Speeds Recovery

Washington, D. C.—

Dissatisfied with the rate industrial codes were coming in, President Roosevelt presented over the radio on July 24 a nation-wide plan to bring all employers quickly into the NIRA fold. Apprehension that production would again outstrip purchasing power and result in a new crash precipitated this action. It was also feared that laggards would take advantage of rising prices and during the month or two of delay before the final approval of the code affecting them would build up inventories on a long-hour, low-pay basis in order to cash in exhorbitant profits.

While commonly called "the blanket code," the plan is not a code in itself, but a voluntary agreement whereby employers agree to limit working hours, to fix mimimum wages, to eliminate child labor, to keep price increases within the limits of increase costs, and other provisions. Copies of the pledge were rushed to five million American employers last week in a spectacular drive to mobilize the man-power of the country. The pledge is not a contract and cannot be enforced by any legal process nor can violations of its provisions be punished. It is to run for four months from August 1 until December 31, except the child labor clause which is effective August 31, and during that time the signer agrees not to violate any of its specific provisions.

The "police power" is to be public opinion which is to be marshalled with a Liberty Loan type of drive. Speakers, radio, advertising, publicity and the activities of local vigilant committees built up on a wartime basis and bringing in 100,000 shock troops and a vast army of others. There is to be what some call a boycott, in that the country will be urged to patronize only the members of N.R.A. and the red, white and blue emblem which will be sent out as a diploma for all who sign up. This will serve to identify the cooperators.

When accused of attempting to ballyhoo prosperity, General Johnson has this to say, "What you are dealing with here is an emergency situation of people out of work after four years of the most exhausting depression that ever hit any country any time. Now we go out and make an appeal to this country to see if we can't get it together for the first time in its history on a question like this under a fundamental law. The possibility of results is illustrated by the problem of child labor. Why didn't it go out 25 years ago? Because nobody in a competitive field could do it, if he were not sure his competitor would do it. But the minute he was sure his competitor would do it, it went out in 24 hours. Now then, here is an effort to apply general rule with a complete set of safety valves to deal with exceptions, and you are going to have everybody under the authority of this act which allows everybody to act together for the purpose of getting rid of this unemployment situation. If that is ballyhoo, whoever uses that epithet as an argument may get a lot of comfort out of it, but I don't think it will take him very far against people who have this poignant thought in their heats and that is everybody. If that is ballyhoo make the best of it".

So the Liberty Loan, gasless Sunday tradition is part of the drive to sell the National Recovery Administration to the American people. To mobilize that public opinion which both President Roosevelt and Administrator Johnson have mentioned so often is the real police power behind the act. The job has been taken on by Charles F. Horner of Kansas City, Mo., organizer of the "Four Minute Men" of wartime days. General Johnson declared himself delighted over getting Horner for the job. Horner moved in with some two dozen designs for labels for goods, buttons, posters, hung them around the walls of the Big Room, left the doors open and everybody had a good look.

This represents the second step taken under the NIRA. The first, to get all of American industry to bring in codes resulted in about 500 such codes being filed, a vast amount and majority of them for small bits of industry. Most of them will require many weeks of work to get them into such shape that they can serve anyone. When it was found that some factories everywhere were working at capacity and piling up stock against the price rises and the day when they would have to pay higher wages and work shorter hours, the blanket code idea was suggested. It was hoped that it could be made compulsory as regards wages and hours, but the law gave no chance for that.

Licensing provisions by which all industry may be put under license from the President required hearings, delays and would have raised far-reaching opposition. The NIRA contains provisions for voluntary agreements, and this was the means chosen. Perhaps it was an admission of failure of the first plan but the times could not wait, and changing tack is no disgrace in the present situation.

Already thousands of employers have

• INDUSTRIAL REVIEW •

Somewhat to the surprise of the old timers in the machinery industry July business was equal to June business in most centers. This does not mean that the majority of machinery builders or distributors have yet reached the black ink stage, but it gives encouragement to those who are looking for some real activity in the fall. Feverish code making and worrying about Washington interpretations of regulations have probably acted as a brake on the forward movement, the blanket code in particular causing uncertainty. The stock market disturbance seems to have had little effect on machinery orders.

In New York, New England and Philadelphia orders are generally for single machines and the June level has been maintained. Inquiries point to better fall business. Pittsburgh reports a substantial improvement in the last fortnight. Orders were placed and inquiries were heavy. In Cincinnati supply business continued good but machine tool orders fell off. Some second-hand business was placed.

Detroit and Cleveland enjoyed something of a flurry over Gen. Johnson's visit. He took a code back with him from Detroit and expressed gratification at the way Cleveland is backing NRA. Supply business continues fair, many companies looking 60 days ahead. No big programs are afoot but there have been some orders for special machines. Indianapolis is beginning to see improvement. Second-hand business is brisk and some orders for new machines have been taken.

St. Louis business is about holding its own and inquiries point to an early improvement. Chicago has had enough business to make the usual summer slump nonexistent and is looking for much better orders in the fall. In Milwaukee employment is increasing and stray orders for machinery are being placed. August is expected to be better than July.

responded to the President's plea and have filed their pledges but underneath the enthusiasm there are many questions and not a little concern. Some of the provisions of the blanket code took industry with the shock of an icy shower while the commodity slump and the stock market break did not help it to get its breath. But many more things were in the blanket code when it began to be considered and thanks should be given that they were eliminated. They need not be listed, but they were all there—all that anybody could have imagined or did imagine. On the whole most of the provisions that would cause far-reaching harm were taken out before the text of the voluntary agreement went through. At any rate the blanket code is having already one effect that was desired, that is to speed up the submission and approval of individual industrial codes.

New deputy administrators for NRA include Professor Lindsay Rogers, well-known student of labor conditions, Philip C. Kempt, New York attorney, W. W. Pickard, also New York, and Major R. B. Paddock, ex-army officer promoted from assistant deputy. The list of deputies is now approaching twenty which is the first limit set. More are to come. The list of assignments of industries to various deputies is growing, will be a cross-section of their adeptness to paraphrase General Johnson's requirement of them.

Coordinated Activities

Whispered news is that a compact "war college" has been set up, and begun to function. Coordination of activities, routing of industries, the deputies known in advance to be the chosen "adepts" in those industries, elimination of duplication and confusion, setting up of censors who can be asked questions and answer them. Industry is really going to have its queries answered after all and is going to get decisions, maybe even on price fixing, cost accounting, production quotas, contracts at our old prices that have to be filled on new wage scales, strikes, white-collar workers, or learn that they cannot get such answers and why. It has been unbelievable that these things could not be answered until industrialists and others made the Washington pilgrimage, but it is going to be over soon and forgotten.

John M. Hancock, business partner of Governor Lehman of New York, organizer of bid drives for business stability is chief of the "war college," called executive officer. His office is evolving into that of the "war college" aforementioned, and as the number of deputies has grown a smaller group is being cut out to do the big job of policy-making, routing, coordinating, laying down the strategy and defining the tactics of the great campaign. All the deputies now meet each morning at 9 o'clock and plans are being laid more and more carefully there.

A part of the organization of the employment situation of the country toward elimination of conflict was a meeting of representatives of various state employment services in Washington. They talked over plans to mobilize so far as employment agencies are needed for the carrying through the public works program from under the NIRA. Secretary Perkins is anxious to avoid the migration of workers who often travel on their last saving on rumors and wild reports.

Limitation of prison production of competitive goods has been suggested to General Johnson by Secretary Perkins as an auxiliary to NIRA programs. She recommended this week that the administrator requests all state governors to adopt a code to this effect. The governors and wardens of many states have volunteered to subscribe to such an agreement. The Secretary of Labor believes that the contract systems should be abolished. While conceding that prison production of goods for state use competes with free labor to some extent, she recognizes that prisoners cannot remain idle and that their rehabilitation depends on training in productive pursuits. A survey by the Labor Department reveals that more than 82,000 Federal and State convicts working for a few cents a day turned out goods valued at $75,300,000 last year. It is hoped that in conjunction with NIRA a movement can be brought to success.

How Will Industrial Codes Affect Equipment Purchases?

Much of the delay in filing and securing approval of industrial codes comes through an obvious lack of understanding by those who drew them up as to the intent of NIRA. Industrialists who have been bewailing the entrance of government into industry, have come to Washington with clauses in their codes that would severely cripple them and which the government has never asked for. Among these provisions are those limiting the purchase and installation of new equipment. Apparently many executives embrace the sophistry that unemployment could be remedied by inefficient operation and were prepared to forego all improvements if their competitors would do likewise. Every effort is being made to correct this false impression as such action is obviously against public interest. In the first place the effect would be to further reduce the already low state of employment in all the capital goods industries. The second effect would be to greatly increase the cost of production which would in turn boost prices to the point where purchasing power would be reduced rather than increased.

For example there are the remarks made by Secretary of Labor Perkins to the effect that "a new meaning must be given to the phrase 'plow back earnings.' They will have to be plowed back into pay envelopes as well as plants and equipment." Superficially this might be construed as derogatory to the installation of new equipment but when questioned more closely, Secretary Perkins pointed out that she did not say the money should go into pay envelopes instead of plant and equipment, but rather *as well as* plant and equipment. "Modernization should never come at the expense of wages," she explained, but added that "one of the arts of industrial management is to know when to make a decision to increase plant structure or improve the plant by installing labor-saving devices. Industrial management," she said, "no longer is a private enterprise. It is touched by public interest at every point. It must be humanistic as well as scientific."

Also certain remarks of General Johnson, having to do with the installation of new equipment in industries already having excess capacity, have been misconstrued as favoring a holiday on modernization despite the fact that General Johnson himself has made it clear that the NIRA involves no curtailment of invention or initiative in mechanical progress. He feels that for the present new equipment installations should be made for replacement rather than for expansion.

German Railways Order Equipment

To assist in the campaign against unemployment, German state railways will purchase about 72,600,000 marks worth of locomotives and rolling stock during 1933, according to a Commerce Department report. Purchases will include 145 steam locomotives, 10 electric locomotives, 221 small locomotives, 109 passenger cars, 232 baggage cars and 839 freight cars.

The Machinery and Allied Products Institute

A Catechism explaining its organization, aims and purposes

Q. *What is the Machinery and Allied Products Institute?*

A. Machinery and Allied Products Institute (MAPI for short) is a federation of trade associations in the field indicated by its name. It has been organized to coordinate the interests of manufacturers of machinery and allied products in their relations with the National Recovery Administration at Washington. Without attempting to deal in detail with the specific problems of individual trade associations, MAPI is designed to handle the common problems of all machinery manufacturers in the preparation of codes of fair competition under the National Industrial Recovery Act. It is the answer to the Administration's expressed preference for dealing with as large groups as possible in preparing industrial codes. Preliminary plans for MAPI were made in a meeting in New York June 23, attended by about 60 representatives of manufacturers of machinery and related products.

Q. *Who are its officers and what are their industrial connections?*

A. President of MAPI is John W. O'Leary, President, Arthur J. O'Leary and Son Co., Chicago. He is past president of the Chamber of Commerce of the United States and of the Chicago Association of Commerce.

Vice-President is Harry C. Beaver, President, Worthington Pump and Machinery Corporation, New York, N. Y.

Secretary is Paul C. DeWolf, Vice-President, Brown & Sharpe Mfg. Co., Providence, Rhode Island.

Treasurer is Robert H. Morse, President, Fairbanks, Morse & Co., Chicago.

Q. *Where is MAPI headquarters and who is the responsible officer to address there?*

A. Headquarters of MAPI is at 221 N. LaSalle St., Chicago. Address John W. O'Leary, President.

Q. *Who are some of the representatives of trade associations now members of MAPI, or closely associated with it?*

John W. O'Leary

A. Russell C. Jones, Griscom-Russell Co., New York.
Philip M. Morgan, Morgan Construction Co., Worcester, Mass.
George B. Torrence, Link-Belt Co., Chicago, Ill.
William C. Dickerman, American Locomotive Co., New York.
Robert E. Friend, Nordberg Mfg. Co., Milwaukee, Wis.
Max Babb, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
D. C. Keefe, Ingersoll-Rand Co., New York.
J. G. Benedict, Landis Machine Co., Waynesboro, Pa.
J. N. Beeler, Ames Iron Wks. Div., Pierce-Butler-Pierce, Oswego, N. Y.
Geo. H. Houston, Baldwin Locomotive Works, Philadelphia, Pa.

Q. *Why was MAPI organized?*

A. Because there was no central coordinating agency for manufacturers of machinery and allied products, in spite of the fact that in the aggregate they form one of the five large industries of the country. Needless conflict of interests might easily prevail in the present emergency in the absence of a central coordinating agency.

Q. *What are the aims and purposes of MAPI?*

A. These may be divided into two classes: immediate, for the emergency; and long-term, for future welfare.

Q. *What are the immediate aims?*

A. (*a*) To include in its membership all eligible groups of manufacturers of machinery and allied products that are not now affiliated with other groups, in order that the Institute may truly represent a majority of the business of manufacturing machinery and allied products, and on that account may speak with authority, and in accordance with the provisions of the National Industrial Recovery Act.

(*b*) To exchange information among its members looking toward the preparation of a common code dealing with hours and wages. (The preparation of agreements covering standards of practice would be left in the hands of the individual groups.) Endless confusion will be prevented if a single agency instead of the representatives of many small groups deals with Washington.

(*c*) To present the true condition of the machinery and allied products industry, with respect to existing and past hours, wages, and volume of business so that the industries and manufacturers represented may not be asked by the Government to accept conditions impossible of fulfillment.

Q. *What are some of the long-term aims?*

A. (*a*) Establishment of the position of the machinery and allied products industry in the public mind on a level commensurate with its position as one of the first five groups of industries in size and importance.

(*b*) Collection, compilation, interpretation and distribution of statistics looking toward operation by the membership of the Institute on a basis of "informed planning."

(*c*) Coordination of the activities of members looking toward unforced stabilization that will result from such tools of management as uniform cost accounting, employee relations, and the like.

In so doing MAPI will develop into a permanent organization of influence and importance comparable to American Iron & Steel Institute, National Automobile Chamber of Commerce and National Electrical Manufacturers' Association.

Q. *Are individuals or companies eligible to membership in MAPI?*

A. No. Membership is open only to trade associations.

Q. *What trade associations are eligible?*

A. Those whose members are engaged in the manufacture of machinery, parts of machines, or allied products. Manufacturers of electrical equipment are not eligible. They belong in the National Electrical Manufacturers Association which has prepared the code governing the electrical manufacturing industry. If you are in doubt about your eligibility, ask Mr. O'Leary, or one of the other officers of MAPI.

Q. *What groups are now included in MAPI?*

A. Diverse groups of manufacturers represented by their trade associations. Typical groups are makers of machine tools, hydraulic machinery, oil and steam engines, air compressors, rock crushers. Prospective members are trade groups representing all kinds of mechanical equipment and related products.

Q. *To what extent is the industry now organized in trade association?*

A. About one-third belongs to strong, well-managed trade associations; one-third is loosely organized in trade associations that meet only occasionally and exercise few of the usual functions of such bodies; the remaining third is entirely unorganized.

Q. *How does the industry represented by MAPI rank with other big industries?*

A. In 1929 the machinery and allied products industries (this excludes electrical machinery and railroad repair shops) employed 830,000 men and paid them $1,400,000,000 in wages. These are round numbers, of course. In comparison the textile industry employed 1,700,000 and paid $1,700,000,000; the food industry employed 750,000 and paid $900,000,000; the automobile industry employed 450,000 and paid $900,000,000. Steam railroads employed 1,700,000 and paid them $2,940,000,000; coal mining, both anthracite and bituminous, employed 630,000 and paid $1,083,000,000; lumber and allied products employed 875,000 and paid $940,000,000; iron and steel employed 420,000 and paid $730,000,000.

Q. *Will a trade association that joins MAPI lose its identity?*

A. By no means. It remains entirely autonomous. If it is now strong it will continue to function as usual. If it is weak the MAPI will stimulate and strengthen it.

Q. *What voice will member trade associations have in the conduct of MAPI?*

A. The governing body of MAPI is composed of representatives of member trade associations. Each member trade association selects one of its own members to represent it on this body.

Q. *What trade association functions can be aided by MAPI?*

A. After the immediate task of drawing up NIRA codes and coordinating them has been accomplished, and they have begun to operate satisfactorily, the MAPI can turn to stimulation of engineering research, qualitative and dimensional standardization, uniform cost accounting, patent pooling (as practiced by N.A.C.C., if this should prove practicable) and improved merchandising methods. Individual trade associations have made some progress in one or more of these activities but the power of a more comprehensive group would accelerate matters considerably.

Q. *What can MAPI do for the machinery industry?*

A. It can present a united front for scattered and diversified groups of manufacturers before the National Recovery Administration in connection with codes of fair competition. Specifically it can present a general code covering common problems, such as hours and wages of labor, leaving to individual associations the preparation of supplementary codes governing marketing policies. MAPI can also represent the whole machinery industry before the National Recovery Administration in establishing the right concept of the capital goods industries and their relation to industrial recovery and prosperity.

Q. *Has MAPI developed a code?*

A. A code has been prepared by a committee which has been in almost continuous session since the formation of the Institute. Preliminary conversations on the terms of the code have been held with NRA officials. The Institute is also preparing to file codes for member trade associations.

Q. *Of what benefit to a trade association is it to join MAPI?*

A. The usual benefits of organization for united action. For example, at the present moment when industry is so vitally concerned in developments at Washington, the voice of a united industry rating among the first five commands attention, whereas the voice of a small trade association or of an individual company would be lost in the general hubbub. Judging by some statements that have come from official quarters there is considerable misunderstanding of the importance of the capital goods industry in our national life. A very strong voice will be needed to carry conviction in these quarters. The capital goods industries have suffered in this depression more heavily than have consumer goods industries. Curtailed production of capital goods has been responsible for a large part of unemployment. Conversely, revival of capital goods manufacturing can bring about an equally large degree of reemployment which is essential to consumer purchasing power. This philosophy must be driven home by a coordinating organization like MAPI in order to counteract tendencies on the part of industry to restrict the purchase of capital goods. Without a general organization representing the whole group, individual associations will find themselves in a vulnerable position.

Q. *What is the attitude of MAPI toward modernization of manufacturing plants and the development of new products?*

A. There has been insistent recurrence of statements to the effect that the increase of efficiency in equipment, and the transfer of labor from human beings to machines should be arrested. It is necessary only to carry this idea to absurdity, that is back to the point where each individual did everything for himself, in order to show that it is impossible of acceptance. The Institute can render a valuable service to its membership and to the public at large by the dissemination of corrective information relative to this fallacy.

The Institute recognizes, however, that there is a tremendous difference between the adoption by industries and by specific plants of more efficient equipment in order to reduce costs of produc-

tion, and the adoption of equipment in order to add to capacity. Industries and individual manufacturers should inform themselves (and here the Institute can be of invaluable assistance) as to the need, or lack of need, for additional capacity and act accordingly; but they should always strive with or without the aid of the Institute to manufacture their products at the lowest possible cost consistent with hours to be worked and wages to be paid, in accordance with agreements that are to be set up.

Q. *What will be the relations of MAPI with such organizations as National Metal Trades Association, American Standards Association, A.S.M.E., etc.?*

A. Friendly cooperation with particular care not to encroach on the functions of any one of them.

Q. *With government departments?*

A. Same as above. In addition the added force of the larger group should be able to clear up such difficulties as the long standing argument over government purchases.

Tool and Die Shops Organize for NIRA

Tonight at the Hotel Pennsylvania, New York, at 7 p.m., representatives of tool and die shops will meet to discuss a tentative code to be presented. A movement starting early in July looked to the formation of the Association of Tool, Die and Machine Shops. It is intended that this organization will cover all shops building dies of all kinds, tools, jigs, fixtures, gages, molds for plastic materials, as well as those engaged in model building, experimental work, designing and building of special machinery and general machine shop work.

At a preliminary meeting attended by members of twelve concerns, a call for a general meeting was sent out to 450 companies. The general meeting was attended by representatives of 104 concerns. The sentiment was for the drawing up of a code to conform to the requirements of the NIRA. Organizers of this move are in touch with local groups in St. Louis, Chicago, Detroit and Central Ohio with the purpose of forming a national organization.

Watson Heads Chamber of Commerce Committee

Thomas J. Watson, president of the International Business Machines Corporation, was recently appointed chairman of the International Committee of the International Chamber of Commerce. At the same time, the appointment of Eliot Wadsworth, former assistant Secretary of the Treasury, as vice-president of the International Chamber was announced.

Mr. Watson succeeds Silas H. Strawn, who held both offices since 1930. He is a member of the Federal Reserve Bank of New York, a director of many industrial and banking institutions and has business interests extending into 78 countries.

Whitman & Barnes Acquire Three Subsidiaries

Three tool concerns, Latrobe Tool Co., Latrobe, Pa., J. M. Carpenter Tap & Die Co., Pawtucket, R. I., and Valley Forge Steel & Tool Co., Chicago, Ill., have been acquired by Whitman & Barnes, it was announced recently. No consolidation of the manufacturing facilities is contemplated according to Clarence Avildsen, newly elected chairman of the board. All companies will operate with the present staffs to provide the maximum distribution of employment in support of the national recovery program.

M. J. Kearins has been elected president of Whitman & Barnes to succeed William H. Eager who remains as director. Mr. Kearins will also continue as president of the Latrobe and Carpenter companies. Henry J. Cogswell will be president of the Valley Forge unit as formerly.

Earl F. Reinhart and Erik Andersen were elected vice-president and treasurer respectively, succeeding Carl Koenig who retired as active officer. Mr. Reinhart has held the position of vice-president of the Latrobe company.

A.S.A. Takes Over Certain Bureau of Standards Work

As the result of an arrangement worked out between Secretary of Commerce Daniel C. Roper and Howard Coonley, president of the American Standards Association, the following activities are to be transferred from the Bureau of Standards of the A.S.A.:

Division of Trade Standards
Division of Specifications
Division of Simplified Practice
Building and Plumbing Code Sections of the Building and Housing Division
Safety Code Section

The A.S.A. is a federation of 37 national technical societies, trade associations and governmental bodies founded 15 years ago as a national clearing house for industrial standardization. This move is intended to preserve the results of services to industry now being discontinued by the government.

Exports of Machinery During June, 1933

	June, 1933	May, 1933	June, 1932
Electrical Machinery	$3,100,134	$3,109,410	$3,438,157
Power generating machinery (except electric and automotive)	357,732	210,715	314,593
Construction machinery	185,126	187,363	325,793
Mining, well and pumping equipment	782,941	890,028	792,906
Power-driven metal working machinery	449,610	430,556	834,352
Other metal-working machinery	81,016	83,574	163,418
Textile machinery	390,735	247,612	856,117

Exports of Metal-Working Machinery During June, 1933

	June, 1933	May, 1933	June, 1932
Engine lathes	$13,674	$7,679	$61,185
Turret lathes	4,744	11,255	4,750
Other lathes	13,328	6,763	5,688
Vertical boring mills	10,925	8,848	102,562
Thread-cutting and automatic screw machines	30,491	19,524	12,001
Knee and column type milling machines	3,409	2,563	30,083
Other milling machines	13,573	14,685	9,470
Gear-cutting machines	31,872	31,962	29,526
Radial drilling machines	....	....	7,028
Vertical drilling machines	14,443	9,659	3,474
Other drilling machines	20,431	7,570	7,837
Planers and shapers	4,500	2,753	30,350
Surface grinding machines	11,132	3,432	2,611
External grinding machines	15,164	34,463	12,386
Internal grinding machines	4,742	9,255	26,840
Tool grinding, cutter grinding and universal grinding machines	24,937	18,073	28,865
Other metal grinding machines	12,665	8,894	38,085
Sheet and plate metal working machines	41,697	53,087	151,124
Forging machinery	17,712	12,741	86,707
Rolling mill machinery	48,999	51,514	13,758
Foundry and molding equipment	17,748	18,558	51,357
Other power-driven metal-working machinery and parts	93,424	97,308	118,665

Other Metal-Working Machinery

Pneumatic portable tools	$24,574	$14,861	$35,335
Other portable hand-operated machines and parts	18,265	17,514	21,275
Chucks for machine tools	3,127	2,871	3,141
Machine-operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	21,213	26,039	....
Other metal-working machine tools	13,837	22,289	16,367

Implement Exports Up in June

U. S. exports of farm equipment during June were 9 per cent higher than for the corresponding month of 1932 according to the Commerce Department. Exports for the first six months were also slightly higher than last year.

June exports were valued at $874,909 compared to $708,640 in June, 1932. Shipments for the six-month period amounted to $5,428,377 as against $5,409,216 exported last year.

The increase was caused chiefly by gains in shipments of harvesting implements and parts, which more than tripled in value. Tractor shipments showed a slight increase.

Canada was the largest market in June, with Argentina next, and the Union of South Africa third.

• BUSINESS ITEMS •

The Selas Co., Philadelphia, manufacturers of industrial gas heating equipment, has expanded its business to include the design and installation of special automatic machinery for all types of industrial heating processes. P. R. HOOPES has been retained as technical consultant.

PENROSE R. HOOPES, consulting mechanical engineer specializing in design of automatic machinery and mechanical products, has transferred his business from Hartford, Conn., to Philadelphia, and is now located at 18th St. and Indiana Ave.

The entire plant of the Fisk Rubber Co. (Western Branch) Federal Rubber Co. Division at Cudahy, near Milwaukee, Wis., will be sold at auction on August 15, 16 and 17, on the premises. The machinery to be sold includes extensive machine and toolroom equipment, woodworking machinery, power and transmission machinery.

The Pneumatic Motor Corp., Indianapolis, Ind., has been formed to manufacture pneumatic, rotary and other motors. Capitalization is 40,000 shares with a par value of $10 each. Incorporators are J. F. SKINNER, J. E. SAMPLE and JAMES E. FRAZIER.

Keystone Valve & Mfg. Corp., Highfield, Md., has been organized to manufacture flush valves and other bronze and metal products. Officers are: HARVEY C. B. BRIDGERS, president; FRANK C. MOORE, secretary and production manager, formerly production manager of the Rotor Tool Co., Inc., Cleveland; and JESSE S. HAYDEN, treasurer and general manager.

The Crawford Valve & Mfg. Co., East Chicago, Ind., has been formed to manufacture valves and power-plant appliances. Capital stock consists of 3,000 shares, par value of $100. Incorporators are W. W. CRAWFORD, FREDERICK C. CRUMMSAKER and JAY E. DARLINGTON.

Representation of the Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y., in Birmingham, Ala., district, is in the hands of the McVoy-Hausman Co., Brown-Marx Bldg. JAMES L. MCVOY, representative for many years, formed a partnership with the Hausman-Harwick Machine Tool Co. under the above name.

Wrought Washer Mfg. Co., 2104 S. Bay St., Milwaukee, Wis., has appointed H. M. SWAIN, 52 Maypole Road, Quincy, Mass., as distributor and representative in the New England States for its line of standard and special washers, corner braces, corner irons and stampings.

The St. Louis office of the Chain Belt Co. has been moved from 339 North Taylor Ave. to 5475 Cabanna Ave.

Sundstrand Machine Tool Co., Rockford, Ill., has appointed R. LEWIS GIEBEL, as representative in the New York territory. His office will be at 1501 Undercliff Ave., Bronx, New York.

• PERSONALS •

DEAN DEXTER S. KIMBALL, College of Engineering, Cornell University, has been appointed a member of the Standing Committee on Awards of the A.S.M.E. by PRES. A. A. POTTER.

THOMAS F. HAMMOND, president of the Whiting Corp., Harvey, Ill., and president of the Illinois Manufacturers' Assn., has been appointed as executive director of the National Emergency Re-Employment program by GEN. HUGH S. JOHNSON.

CHARLES B. SMITH has resigned as president and member of the executive committee of the Stewart-Warner Corp.

C. F. SMITH has been appointed factory manager for the American La France and Foamite Corp., Elmira, N. Y. He succeeds H. S. SNODGRASS who resigned because of ill health.

WALTER GEIST, assistant manager of the milling machinery dept., Allis-Chalmers Mfg. Co., Milwaukee, and the inventor of the Allis-Chalmers "Texrope Drive" has been appointed general representative for the company. L. W. GROTHAUS, who served as general representative, has been appointed assistant to the president, and will direct the company's interests in matters pertaining to National Industrial Recovery Act, as it relates to commercial problems.

JOHN L. HECKMAN, president of the Heckman Machine Works, Chicago, Ill., has been elected president of the Automotive Engine Rebuilders Association.

• OBITUARIES •

FRANK W. PEEK, JR., chief engineer of the Pittsfield, Mass., works of the General Electric Co., was killed on July 26 at a grade crossing in Canada. Mr. Peek was probably best known for his work in the field of lightning research. He had continued much of a general line of investigation begun by the late CHARLES C. STEINMETZ, under whom Mr. Peek worked for a period during the earlier part of his career.

ALEXANDER CHURCHWARD, engineer of the Wilson Welder & Metals Co., Inc., North Bergen, N. J., died at the age of 60. He became identified with the Wilson Welder company in 1921, and spent his life in electrical research and development work.

BURTON C. SMITH, president of the Smith Manufacturing Co., La Crosse, Wis., died July 18, at the age of 64. For many years he was an official of the La Crosse Plow Co.

Charles Pfeiffer, organizer in 1890 of the Pfeiffer & Smith Co., manufacturers of machinery, died July 21.

A. B. BROWN, manager of the metal goods division, Risdon Mfg. Co., Waterbury, Conn., died at the age of 38.

• MEETINGS •

NATIONAL ASSOCIATION OF FOREMEN. Annual convention. September 15-16. Akron, Ohio. E. H. TINGLEY, secretary, Refiners Bldg., Dayton, Ohio.

NATIONAL METAL CONGRESS AND EXPOSITION. October 2-6. Detroit, Mich. Under the auspices of the American Society for Steel Treating. W. H. EISENMAN, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SILVER BAY INDUSTRIAL CONFERENCE. Sixteenth annual conference on industrial relations. August 23-26. Silver Bay on Lake George, N. Y. E. C. WORMAN, secretary, 347 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. International automotive engineering congress. August 28-September 4. Palmer House, Chicago. JOHN A. C. WARNER, general manager and secretary, 29 West 39th St., New York, N. Y.

American Machinist
REFERENCE BOOK SHEET

Machining Aluminum and Its Alloys

SUCCESSFUL machining of aluminum and its alloys requires changes in tools used as compared to those employed for steel and free-cutting brass. The proper tools should have appreciably more side and top rake than the tools for cutting steel; should have very keen edges obtained by grinding with fine or very fine abrasive wheels supplemented by hand stoning with an oilstone, and should be used with suitable cutting compounds.

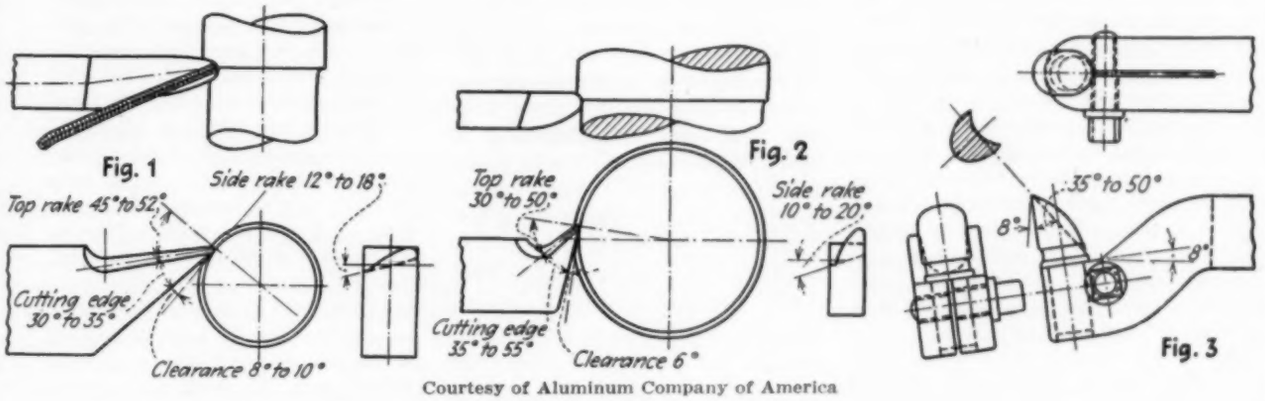
Except for aluminum alloys high in silicon content, carbon steel and high-speed steel tools may be used satisfactorily. Carbon steel tools may generally be maintained with a keener cutting edge. Cemented tungsten carbide tools are necessary for machining the high silicon alloys, notably "Lo-Ex" No. 132 piston alloy. Carbide tools are also superior to carbon and high-speed steel tools under severe production conditions because the keen edges are maintained over very long periods without regrinding. Diamond tools are often used for boring holes where a fine, accurate finish is desirable, such as piston pin holes.

CUTTING SPEEDS. Aluminum can be machined to best advantage by using comparatively high speeds and fine to medium feeds. Surface speeds from 500 to 800 ft. per min. are possible under some conditions with ordinary carbon-steel tools, and appreciably higher speeds with high-speed steel and carbide tools. The feed may vary from ¼ in. for roughing cuts to a few thousandths for finishing cuts. An increase in the amount of metal removed from the stock can often be obtained to better advantage by increasing the speed rather than the feed. The work should often be cooled before calipering and finishing to size.

CUTTING LUBRICANTS. Some form of lubricant is desirable. For many purposes a soluble cutting oil is good. Ordinary carbon oil or kerosene will often serve, but usually works better when mixed with lard oil, usually in equal parts. For heavy cuts and slow feeds, such as in roughing work or tapping, pure lard oil gives good results. Cutting compounds of paraffin oil are unsatisfactory. For milling, sawing and drilling, the soluble cutting oils are satisfactory and more economical than kerosene or kerosene and lard oil lubricants.

LATHE TOOLS. For lathe work, using the round-nosed tool, Fig. 1, the tool should be set to have proper clearance and not curl the chip more than necessary. Before finishing with the tool, its edge should be re-stoned. It is best to set the lathe tool considerably higher on the work than when machining brass or steel, preferably on a diameter of the work, making an angle of 45 deg. with the horizontal. The tool shown in Fig. 2 is satisfactory for large diameter work where the tool must be set on or near the center of the work. A much better tool is shown in Fig. 3. Resharpening is accomplished by holding the bit by its shank in the chuck or collet of a tool grinder or a lathe and grinding off the outside diameter until a keen edge is obtained. After each grinding the tool should be stoned. When the clamp screw of the tool-bit holder is loosened, the bit may be rotated to various positions and adjusted to different working conditions. Tools of this form may be used for both rough turning and finishing cuts. Parting tools for machining aluminum and its alloys should have from 12 to 20 deg. top rake and be stoned. The front clearance angle should be decreased to about 3 or 4 deg. Facing tools should be ground to have a side rake similar in amount to that indicated for the top rake of the outside tools. Circular forming tools are difficult to design to machine aluminum and its alloys properly. Best results are obtained by using a roughing tool first, followed by a very light finishing cut with the forming tool.

PLANER AND SHAPER TOOLS. The tool shown in Fig. 3 may be adapted readily to planer and shaper work by using a holder, Fig. 4. This tool may be used for both roughing and



Courtesy of Aluminum Company of America

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REFERENCE BOOK SHEET

Machining Aluminum and Its Alloys

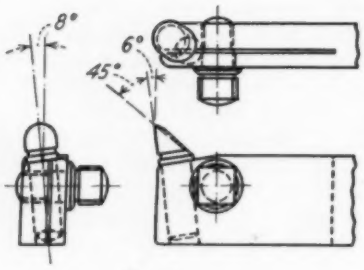


Fig. 4

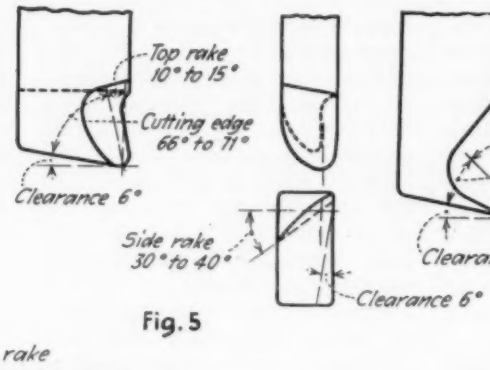
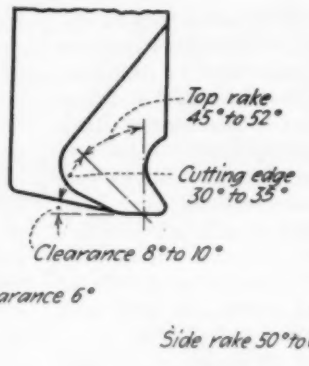


Fig. 5



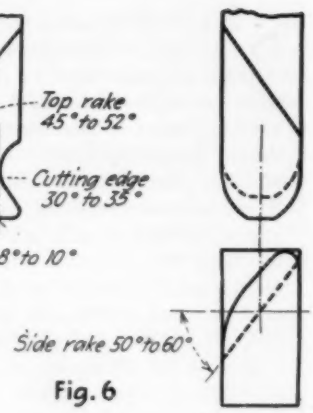


Fig. 6

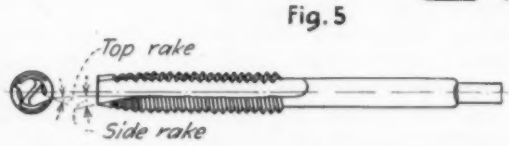


Fig. 7—Gun tap for aluminum with short spiral on the front end

finishing. If very heavy roughing cuts are desired, a side cutting tool, Fig. 5, can sometimes be used to better advantage. For planer or shaper work, the roughing tool should do nearly all of its cutting on the side of the tool, while for finishing work, the cutting should be done with the front or bottom edge of the tool. The finishing tool, Fig. 6, should be used for light cuts with fine feeds only. Provision should be made to prevent the tool from striking the finished work on the return stroke. The side cutting and bottom cutting features for roughing and finishing in shapers or planers may be obtained with the tool shown in Fig. 4, by rotating the toolbit in the proper direction.

Milling Cutters. Milling cutters, straddle mills, end mills and similar cutters work to best advantage if they are of the coarse-tooth spiral-type and have considerable top rake. In some instances milling cutters with nicked teeth assist in decreasing the chip size. Inserted tooth face-milling cutters should be designed with appreciable top and side rake. Helical milling cutters work well if the cutting edges are provided with suitable top rake. The same may be said of staggered-tooth milling cutters.

Threading Tools. It is desirable, both in the case of threading dies or thread chasing tools to provide special rake and clearance. Threads may be chased in the softest aluminum, using a single-pointed threading tool with considerable top and side rake. Hand and machine taps will produce smooth and accurate threads if they are of the spiral flute, ground-thread type. Such taps should have a right-hand spiral flute when intended to cut a right-hand thread. Spiral angle should be similar to that used in an ordinary twist-drill. Taps which have a short spiral ground on their front end, such as the "gun" tap, Fig. 7, will often work satisfactorily when there is room for the chips to be forced ahead of the tap and when the thread to be cut is not tapered. When using spiral-fluted taps, especially in automatic screw machines, it is best to grind a top rake on the back of the lands so that there will be less tendency for the tap to seize when backing out. Slightly oversize taps assist in maintaining required dimensions of holes in aluminum and its alloys. Thread chasers for self-opening dieheads and collapsible taps should be ground with appreciable top and side rake. Generally speaking, tapping speeds are slow and depend upon factors such as the size of the tap drill used, the depth of tapped hole and the alloy tapped. In some instances, tapping speeds approximately equal to those employed for steel may be used. Screw machine products are generally provided with about 67 per cent of full thread.

Twist Drills. Ordinary twist drills sometimes give trouble. They should have keen edges and a copious amount of cutting compound should be used. For some work the single-fluted twist drills used for hard wood have been found superior to the usual form of drill. A still better form is one in which the flutes have a greater spiral angle. Straight-fluted twist drills, such as are often used in drilling brass, are quite unsuited for drilling aluminum and its alloys. Reamers of the spiral-fluted type are best.

Saws. Saw teeth should have considerable top rake and some side rake, the latter depending upon the type of saw tooth used. Saws of the alternate side-rake type or those of the chip-breaker type (teeth of alternate square and rounded front profile) may be used. A side rake of 15 deg. is recommended for the former. For either type, a front or top rake of 10 to 25 deg. is recommended. To use a saw with much front rake, the sawing machine must be provided with a positive feeding device to prevent the saw from feeding into the work too rapidly.

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Can the Small Shop Specialize?

FRED H. COLVIN
Editor, American Machinist

OPINION is divided as to whether the small shop should specialize. Some contend that the most successful shops choose the kind of work they can handle best and stick to that. If, for example, the small shop boss is an expert at punches and dies for difficult drawing work, he can give better service than a shop where they tackle any kind of a job that comes along. Incidentally, he can charge a good price because he gets a lot of work that other shops fail to do satisfactorily and because he saves the customer a lot of time and money.

This is good advice as far as it goes. But it frequently happens that punch and die work slumps off a bit while the rent and the grocers bills go on just the same. Shall the boss lay off his men and go fishing until someone wants more punches and dies? That might depend on his men and how well he likes to fish.

The Back Log

Few small shops can afford to wait for their particular specialty and need some sort of a back log to keep things moving. A secondary specialty might do, or even a line of general repairs, when small contracts for parts or complete machines cannot be had. The question is, what shall the specialty or specialties be? How shall they be selected?

Perhaps the first things to consider are the experiences of the men in the shop and the equipment. Next, what sort of work is most prevalent in the district or within a reasonable distance. This is much more important when starting a shop than after it secures a reputation. I know a small shop in Illinois that specializes in heat treatment. Tools, gears, clutches and all kinds of parts made in this manufacturing section come to his shop. Now, after establishing a good reputation he gets work from points over a thousand miles away. As a matter of fact, heat-treatment of steels makes a good back log in any locality, even though it requires rather expensive equipment and considerable experience. But the responsibility that goes with it entitles anyone to charge a good price for the work, even when done in quantity.

Much depends on the location of the shop. If it is in an agricultural district, a thorough knowledge of tractors, farm machinery of all kinds, lighting plants and even sewing machines and radios will not be amiss. Welding is always in order and has almost no limit to its application. It will be said that garages get all the tractor and automobile work and take it at ruinous prices. There are, however, comparatively few garage or service station men who really give satisfaction. It is one of the weak spots of the automobile industry. Many experienced drivers never take their cars to the authorized service stations of their make of car, but find some good "alley-mechanic" who knows his job and who gives much better satisfaction.

Whatever locality you are in, study the kind of machines used in your district. It may even pay to spend a little time in the shops where the machines are built. Keep posted by having the latest catalogs on hand. The manufacturers will be glad to cooperate when they find you know your job and mean business. Good customers will gladly pay a fair price for a good job. If not, they are not the kind of customers you want—let the other fellow have them.

Charging for Repair Work

One great cause of disputes and misunderstandings is the repair of articles that cost very little when new. Globe valves, plug cocks and the like are good things to steer clear of. It frequently costs more to repair them than to buy new ones. You can easily spend five times the cost of a new valve in fitting a new plug in the cock body. Articles of this kind are made in large quantities, usually on special machinery, and at very low cost. It is usually far cheaper to buy a new one and throw the old one away. And when, as sometimes happens, it is necessary to make some sort of repair to prevent shutting down a machine or delaying operations the owner should be willing to pay for the actual cost of the work, plus a profit. He is not paying so much for the repair of the valve as for his lack of foresight in not having a new one ready to put in place, and to avoid far greater losses by shutting down the machines.

The extent of specializing that is advisable depends largely on the location of the shop. If there are other good shops nearby it might be well for each to specialize on one or more operations, as well as on certain classes of work. One shop may have a good planer, another a gear cutter and a third first class turret lathe equipment. It will frequently pay them to cooperate to the extent of letting each shop do the work for which it is best equipped.

Some Special Machines Pay

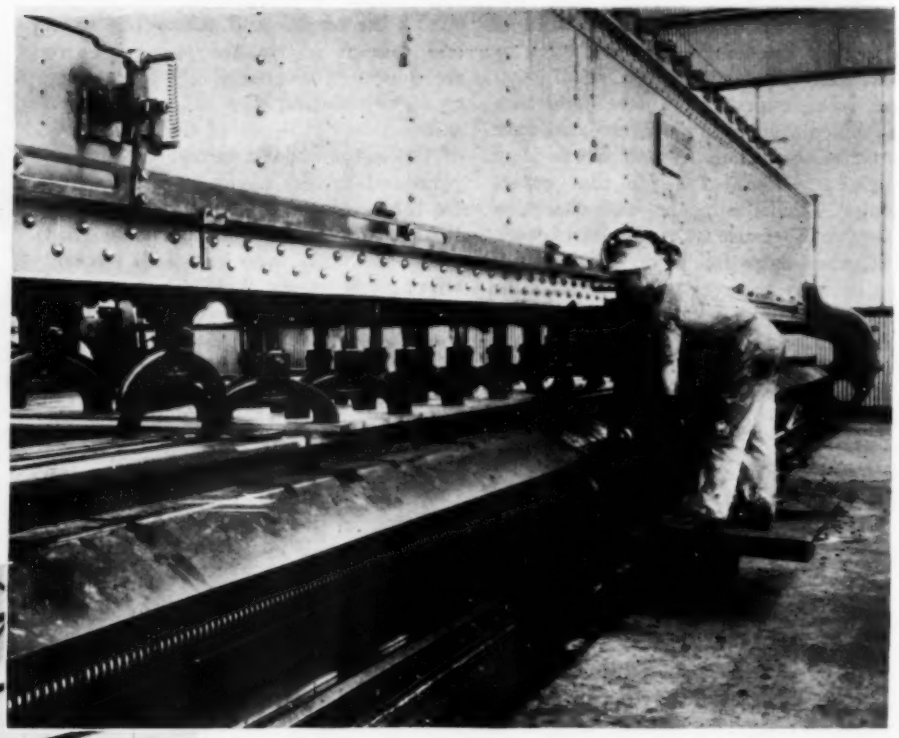
A shop specializing in tools such as drilling jigs, punches and dies, and the like, will do well to consider the purchase of a good jig-boring machine. Of course this runs into more money than most small shops feel they can afford. But such a machine has far wider uses than we used to think. Instead of being exclusively a toolroom machine, it is being used extensively in small lot production as well. Such a machine will save time and mistakes in laying out jig bushing holes and guide pins for punches and dies of the sub-press variety. It will enable a good mechanic to bore numerous holes in brackets, bases or other parts of machines in as exact duplication as though he had made a jig for the parts. When building parts in small quantities this effects a great saving.

Of course similar work can be done on a good horizontal boring machine, a good milling machine, and in some cases on the face plate of a lathe. But the work can be done more quickly and with less chance of error on the jig-borer. Such a machine should give the shop owning it first call on all work of this kind in the neighborhood. In one small shop I know of a jig-borer proved to be a magnet in drawing a lot of work from surrounding towns and cities. Special equipment or special ability attracts profitable work.

It is not advisable, however, to tie up too much capital in special machines or tools. Here, as elsewhere, good judgment draws big dividends. It frequently happens that saving a little labor is an expensive proposition. If the jig borer, for example, could only be used in laying out the jigs likely to come to the shop, it would probably be cheaper to use the horizontal boring machine, the miller or even a lathe. You wouldn't be likely to buy a milling machine solely for jig work either. But having it to use for a lot of other work makes it profitable. Boiled down, this means that few small shops can afford to buy highly specialized machines or tools. There is, however, no hard and fast rule in the matter. Sometimes a tool will pay for itself by preventing errors and spoiled work.

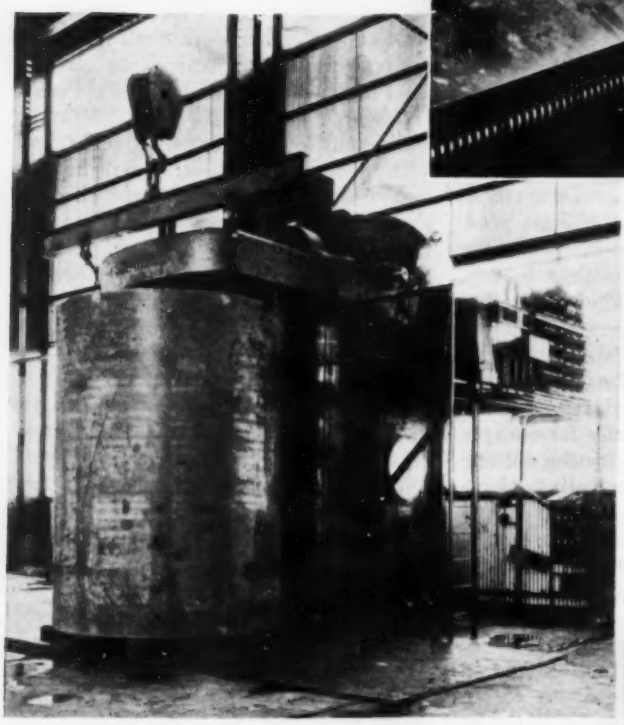
Field Fabrication of Steel

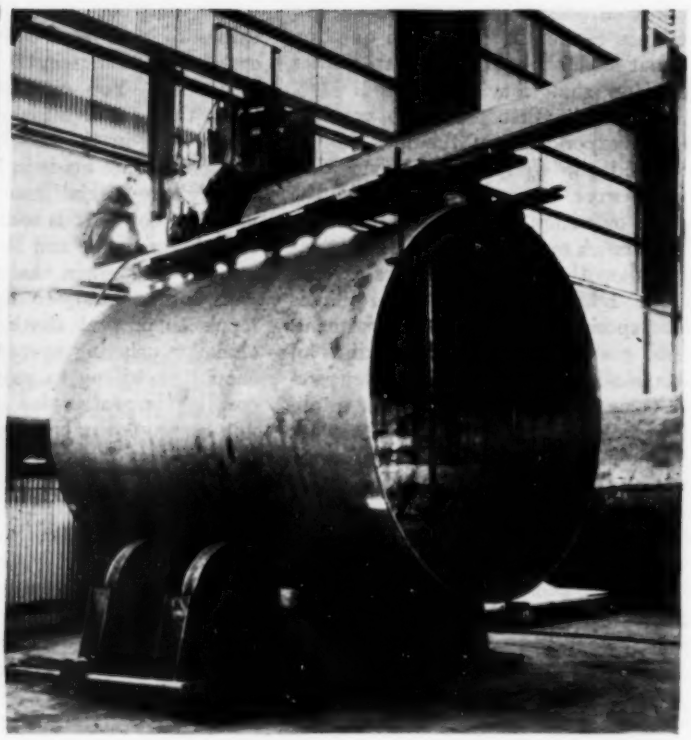
Photographs taken at the Babcock &



Operating side of the Sellers plate planer, showing set-up of the plate and toolholders. Edges of plate up to 2¾ in. in thickness will be planed and beveled preparatory to welding

Southwark vertical plate bending roll previously described (*AM*—Vol. 77, page 156). A pipe section 8½ ft. in diameter is in progress of rolling. Pipe from ⅞ to 2¾ in. in thickness will be fabricated

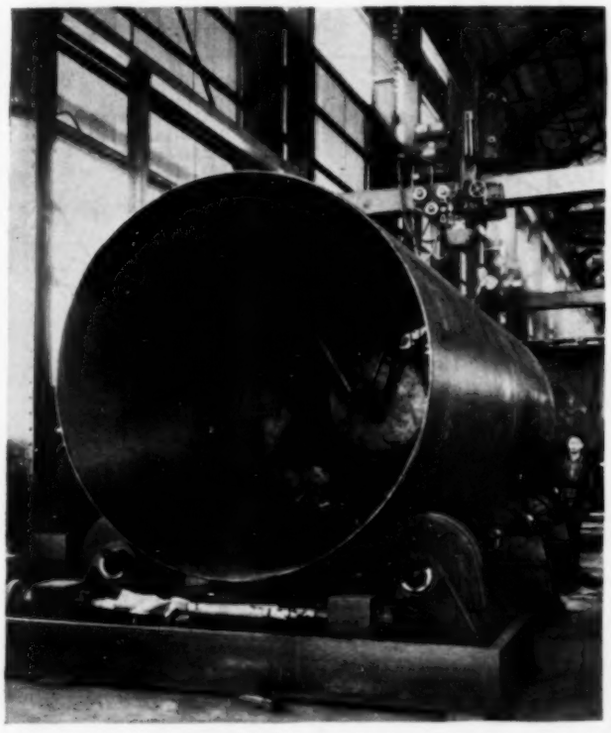




Welding the longitudinal seam on a pipe section 8½ ft. in diameter, using an automatic fusion machine. A specimen tacked to the end of each seam serves as a record of the weld

Pipe for Boulder Dam

Wilcox plant at the dam site



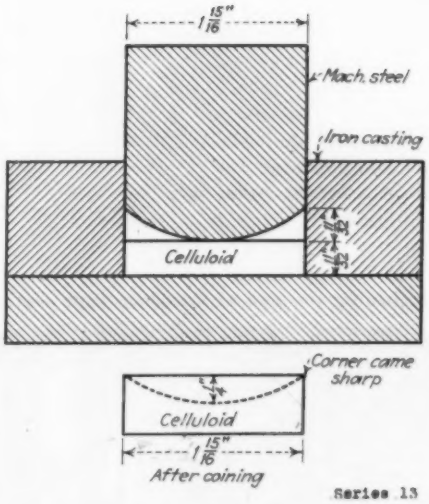
Two 8½ ft. sections mounted on rolls under the automatic fusion machine for welding the girth seam. A spider holds the seam in alignment

Machining the end of an 8½ ft. pipe section

Work in progress consists of sections 8½ ft. in diameter and having thicknesses of $\frac{7}{8}$ and 1 in. The contract also calls for pipe in diameters of 13, 25 and 30 ft. and thicknesses of 1 to 2$\frac{3}{4}$ in. Approximately 400,000 linear ft. of welding will be required

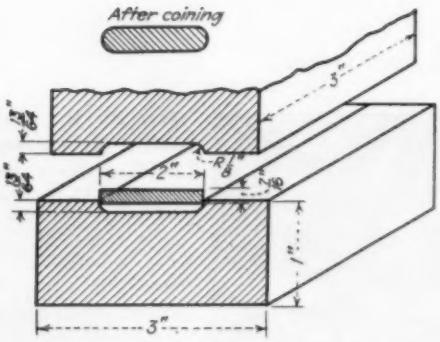
Press Work Pressures

Series XII—*Coining*

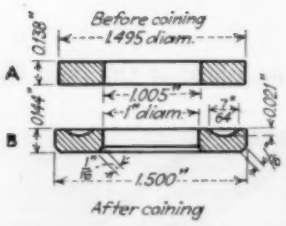


Series 13

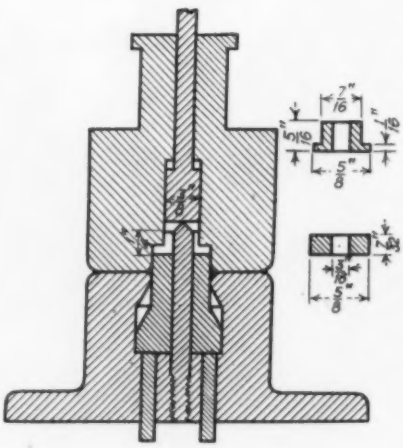
Material--Celluloid, 11/32 in. thick
Operation--Shape as illustrated
Pressure--44,000 lb.



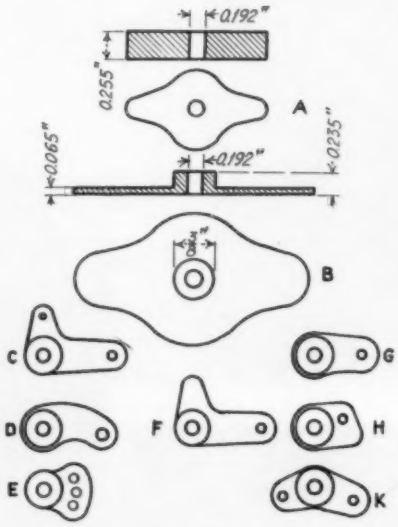
Material--Ordinary machine steel, 7/16 in. thick by 3 in. long
Operation--Coin the edges of strip round
Pressure--100,000 lb.



Material--Soft machine steel, 0.138 in. thick
Operation--Coin A into B
Pressure--104,000 lb.

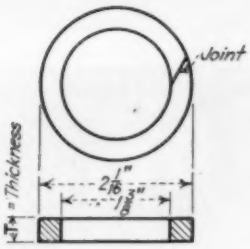


Material--Low carbon temper steel, 7/32 in. thick
Operation--Coin a flange on washer
Pressure--70,000 lb.



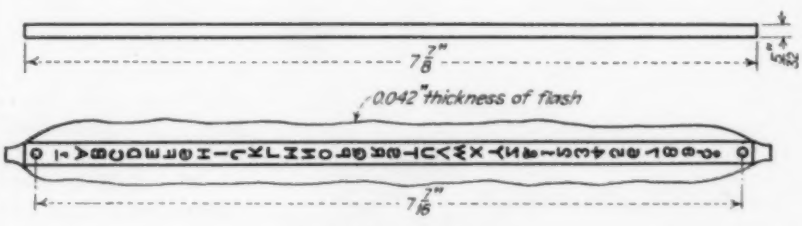
Material--Low carbon temper steel, 0.255 in. thick
Operation--Coin A into B
Pressure--300,000 lb.
Pieces C, D, E, F, G, H, K were blanked from piece B, one die to each part. Waste of material was offset by savings in die costs

Material--Woven asbestos ring, 0.212 in. thick
Operation--Compress 1 in. of surface from a thickness of 0.212 in. to 0.159 in.
Pressure--4,500 lb. To coin the entire ring required 110,000 lb.



Material--Woven asbestos, various thicknesses
Operation--Coin a ring
Pressure--See table

Thickness Before Coining	After coining	Pressure in tons
0.403 in.	.375 in.	1-1/2
"	.364	2
"	.360	2-1/2
"	.355	3
"	.346	3-1/2
"	.342	4
"	.338	4-1/2
"	.331	5
"	.325	5-1/2
"	.322	6
"	.319	6-1/2
"	.317	7
"	.315	8
"	.313	8-1/2
"	.312	9
"	.296	9 Rather thin
0.437	.370	9 Thickest ring



Material--Aluminum, 5/32 in. in diameter
Operation--Coin into strip for toy typewriter
Pressure--300,000 lb.

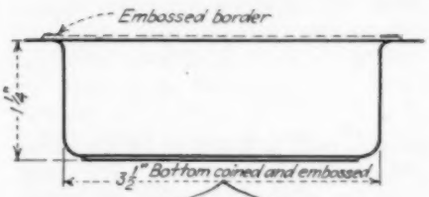
Contributed by C. W. LUCAS *© American Machinist*

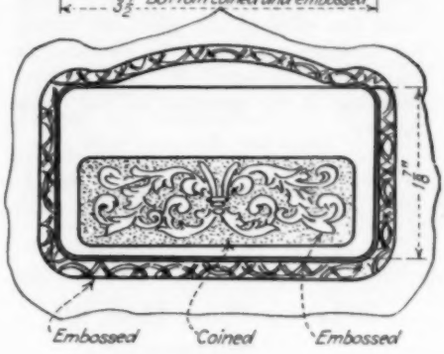
Press Work Pressures

Series XII—*Coining*

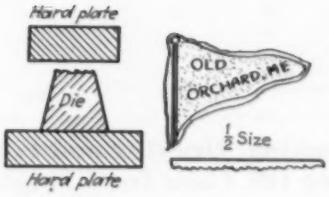
½ Size

Material--Cast brass
Operation--Coin image sharply
Pressure--200 tons

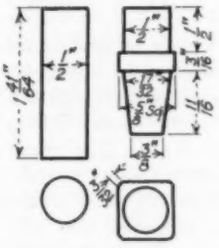




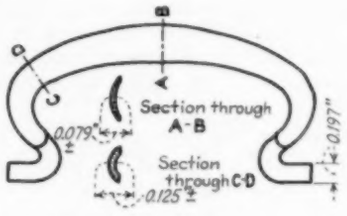
Material--Sheet brass shell, 0.027 in. thick
Operation--Coin and emboss at one stroke in 250-ton press
Pressure--Press taked to the limit



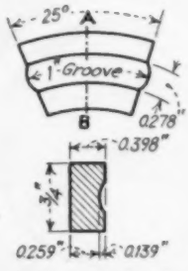
Material--Soft bronze plate
Pressure--40 tons



Material -- Steel
Pressure -- 250 tons

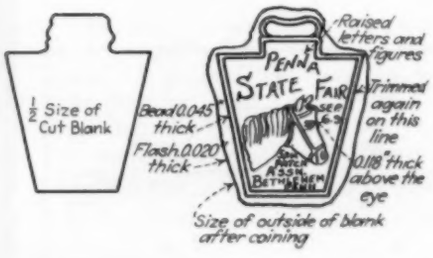


Material--Round soft-steel wire
Operation--Coin drawer pull
Pressure--120 to 150 tons calculated from test

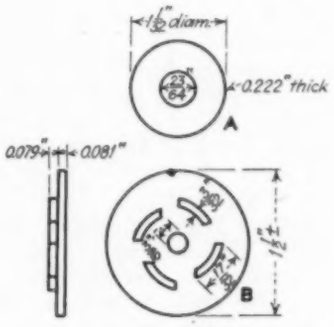


Section through A-B

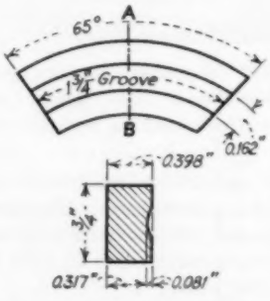
Material--Soft machine steel, 0.398 in. thick
Operation--Coin groove in segment of a ring
Pressure--40,000 lb.


½ Size of Cut Blank
Raised letters and figures
PENNA STATE FAIR
Trimmed again on this line
Bead 0.045" thick
Flash 0.020" thick
0.118" thick above the eye
Size of outside of blank after coining

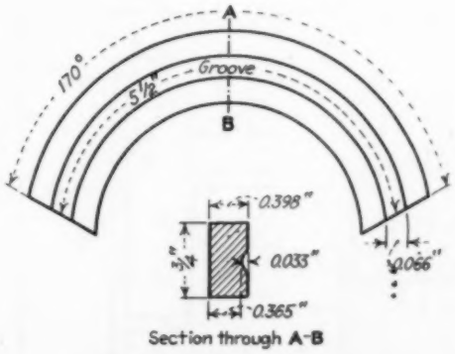
Material--Aluminum, 0.072 in. thick
Pressure--150 tons



Material--Low carbon temper steel, 0.222 in. thick
Operation--Coin A into B
Pressure--300,000 lb.

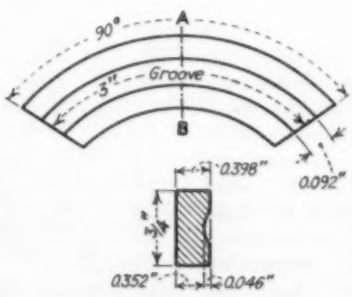


Material--Soft machine steel, 0.398 in. thick
Operation--Coin groove
Pressure 40,000 lb.



Section through A-B

Material--Soft machine steel, 0.398 in. thick
Operation--Coin groove
Pressure--100,000 lb.



Material--Soft machine steel, 0.398 in. thick
Operation--Coin groove
Pressure--70,000 lb.

Contributed by C. W. LUCAS *American Machinist*

IDEAS FROM PRACTICAL MEN

Blanking, Drawing and Pinching Off Tools for a Single-Action Press

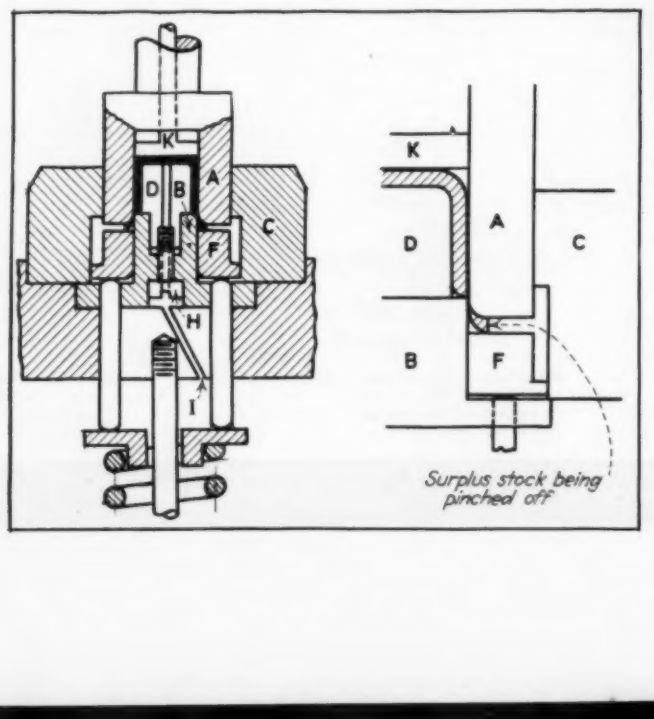
W. E. GOCHNAUER

The tools illustrated are for use in a single-action press for blanking, drawing and pinching off the surplus stock at the edges of shells in one stroke of the press, thus eliminating the extra operation of burring or trimming.

While the blanking and drawing features of the tools will be understood without explanation, there are some very important points to be considered in their construction. Accurate alignment at assembly must be maintained and the inner diameter of the drawing ring *A* must be held as close as is possible to the outer diameter of the pinch-off punch *B*. It is also important that the outer diameter of the drawing ring should fit the blanking die *C* very closely to eliminate any danger of shear. The difference between the diameter of the drawing punch *D* and that of the pinch-off punch *B* should be twice the thickness of the stock.

The surplus stock is pinched from the edges of the shells by the passage of the drawing ring over the pinch-off punch and the stock so pinched off is rigid enough to strip the shell from the drawing punch as the ram ascends and the stripper ring *F* (which is also the pressure pad) is forced up by the spring acting on the pressure pins. For sharpening the edge of the pinch-off punch, the drawing punch can be removed by taking out the screw *H*. The positive knockout *K* is operated in the usual manner.

This pinch-off method can be applied to work of irregular shape where the draw is not too shallow and the stock is not too heavy.

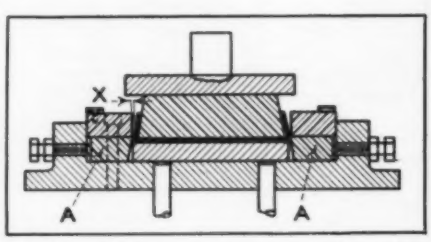


Pinching off surplus stock from a blank saves a second operation. The tools must, however, be made very carefully. The illustration shows how the pinches and dies are designed

Bending More Than 90 Degrees

ERNEST FOLDVARY
Budapest, Hungary

A simple die for bending the edges of sheet-metal work more than 90 deg. is shown in the illustration. As the ram descends, the ends of the work are bent at a right angle. Continued descent of the ram pushes the work down past the adjustable blocks *A*. These blocks are adjusted to the dimension *X*, which varies according to the thickness of the metal. As the work contacts with the edges of the blocks *A*, the corners of the bend are ironed or pinched, pushing some of the outer skin of the metal upward and causing the bent edges to incline inwardly.



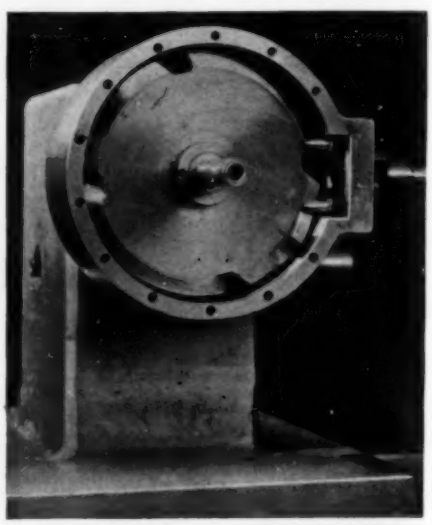
This die irons the outer skin of the blank and forces the ends inwards

The amount that work can be bent more than 90 deg. depends upon the thickness of the metal, but in any case it should not be less than $\frac{1}{8}$ in. thick. With metals more than $\frac{1}{8}$ in. thick, the ends of work can be bent to an angle of 80 deg. measured from the inside.

A Silent, Intermittent Motion

FRANK C. HUDSON

Here is a way of getting an intermittent motion at right angles to the drive shaft. The large disk with the four slots and the high spots between is on the driving shaft. The cross shaft has four tapered rollers, two of which are shown. With the disk turning to left, or counter-clockwise, the lobe lifts the tapered roller in contact with it and forces the upper roller into the slot just below it, and the intermittent cross shaft is moved a quarter turn. The next high spot repeats this movement giving two quarter-turn movements to each revolution of the disk.



Talking pictures require silent mechanisms. This device gives intermittent motion without noise

Wear is taken up by moving the tapered rollers deeper into the slots in the disk. This has proved to give a positive, silent movement, and is used in the motion picture industry in Hollywood. It can, of course, be modified as to movement for other uses.

Graduated Diemaker's Square
Discussion

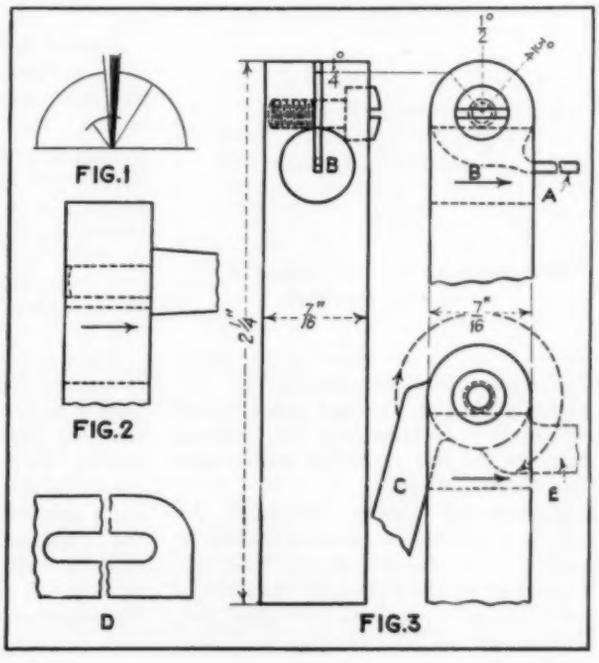
CHARLES F. KRAUT

The article by Charles Weslow under the title given above (*AM*—Vol. 77, page 153) is interesting. The cam design is both original and practicable, though if the cam were placed above the blade, instead of below, it would permit an unobstructed view of the blade in contact with the work. The cam permits wide spacing of the graduations, whereas if the disk described in John E. Hyler's discussion of Mr. Weslow's article (*AM*—Vol. 77, page 314) were graduated, the lines would converge into a solid mass near the center, as shown in Fig. 1. Therefore they would be difficult to distinguish without the aid of a magnifying glass, and subdivisions of a degree would be almost impossible to read. Another objection to Mr. Hyler's square is that it cannot be used in very small holes, as the view of the blade would be entirely obstructed by the stock.

The design of the square illustrated by L. Kasper in an article under the title "A Diemaker's Square" (*AM*—Vol. 77, page 285) is clever; however, the square would have a wider range of usefulness if a hole were drilled in the stock near the shank of the plug, as in Fig. 2. This hole would be essential if the square were to be used in checking the clearance angles in the openings of small piercing and blanking dies.

A practical design of a diemaker's square is illustrated in Fig. 3. Such a square is especially adapted for checking and obtaining the correct clearance angles in small and odd-shaped openings and die bushings in piercing and blanking dies. For this class of work the small blade *A* is used. Looking through the hole *B* in the stock in the direction indicated by the arrow, an unobstructed view of either edge of the blade is presented to the eye as it is brought into contact with the work. Since this blade is to be used on dies not more than 1 in. thick, it projects but 1 in. from the stock. For larger dies and other work the blade *C*, projecting about 1½ in., is used. For general work the slotted and adjustable blade *D* is used. Other blades, as at *E*, can be inserted.

To avoid congested graduation lines, the graduations for ¼, ½ and ¾ deg. are laid out independently, as seen, and are scribed on both the stock and the blade, the figures being stamped on the stock. In setting the blades accurately to other desired angles, it is better to use a vernier protractor and, if necessary, to use it in conjunction with a bevel gage. This method is good practice and experienced toolmakers and diemakers are familiar with it.

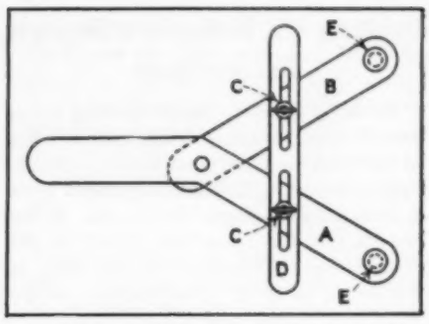


Diemaker's squares of different designs, using tapered plugs and adjustable blades of various shapes to suit the work. They can be set with a vernier protractor for greater accuracy

A Universal Pin Wrench

JOHN E. HYLER

Pin wrenches, like other tools, have a flair for getting lost and sometimes it seems as though they were the worst offenders, no doubt because they are used less often than most other tools. However, if one keeps a pin wrench like the one illustrated in his toolkit, he will always have a wrench that can be adjusted to suit the occasion. It is adjustable for any distance between the center of the pins within its range and, since the pins are screwed into place, they can be removed and a pair of different diameter can be substituted when necessary.



A pin wrench that is easily adjusted to fit any hole spacing

The part *A* is bent to form a handle and the part *B* is pivoted to it. Both parts are drilled and tapped for the shouldered thumbscrews *C* for holding the slotted strut *D*. The business ends of both parts are drilled and tapped for the shouldered pins *E*, which are hardened. The holes for the pins are tapped small enough so that the smallest pins likely to be needed will have a small shoulder. As many pairs of pins of different diameters may be made as is found desirable.

Adjustment can easily be made—trial and error are not necessary. Either or both of the thumbscrews can be loosened and the pivoted parts can be opened or closed until the pins enter the holes in the nut. Tightening the thumbscrews makes the wrench practically as rigid as if it were solid.

Boring Heads and Prevention of Chatter

J. T. TOWLSON
London, England

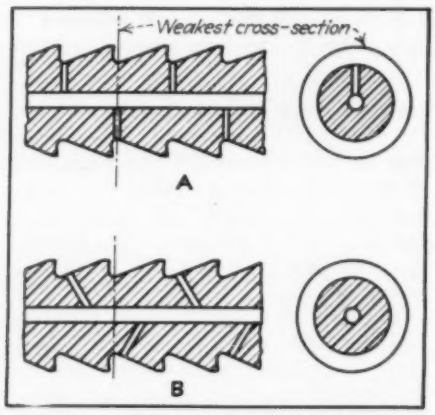
When boring cylinders, chatter is a most annoying bugbear to the machine operator. Chatter especially ocurs when the metal in the cylinder is fairly hard, and not only is the noise produced objectionable, but the resultant work gives evidence of the chatter.

Text books for mechanics illustrate and describe boring heads in which the two cutting tools are diametrically opposite each other, particular attention being given to having the tools point radially. Such a design of boring head will chatter, and the usual "damping" method is to have an associated following head "clogged" with hardwood blocks. If, however, the tools are set tangentially, as shown in the accom-

Drilling Oil Holes in a Broach

EMIL WITTMANN

Recently I saw a shop drawing for a broach for broaching long, round holes in material that required the use of cutting lubricant. The drawing called for a central hole through the length of the broach and for connecting holes for the distribution of lubricant at the roots of the teeth, as at *A*. Fortunately, before



Drilling oil holes in broaches so as to preserve greatest strength

the distributing holes had been drilled it was discovered that their location would be in the weakest cross-section of the broach and might endanger breakage.

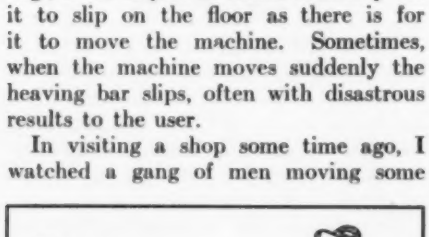
Consequently the drawing was corrected, as at *B*, so that the distributing holes were to be drilled at an angle beginning at a point a little way from the roots of the teeth and away from the weakest cross-section.

A Non-Slip Heaving Bar

MATTHEW HARRIS

Every one who uses a heaving bar to move machinery knows that when the bar approaches an angle of about 45 deg., there is just as much tendency for it to slip on the floor as there is for it to move the machine. Sometimes, when the machine moves suddenly the heaving bar slips, often with disastrous results to the user.

In visiting a shop some time ago, I watched a gang of men moving some machinery and my attention was attracted to the heaving bars they were using. On examining one I found it to be made as per the accompanying sketch. The base *A* had three calks on the bottom and its top was concaved to fit the ball *B*, which was loosely held in place by the U-shaped strap *C*. The ball had a short shank over which a piece of pipe was fitted for a lever. It will be understood that the ball permitted the base to be moved in any direction, and that it could not slip because the calks would dig into the floor.



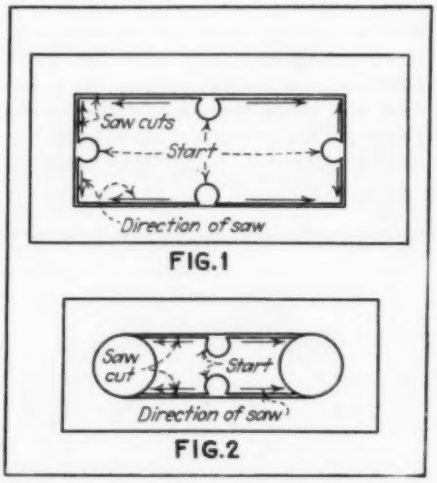
This heaving bar has a base that cannot slip and cause damage

Short Cuts for the Diemaker

WILLIAM ANDERSON

In shops where there is no bandsaw for sawing out the cores of dies, much time can be saved by using the power hacksaw for cutting the cores out of rectangular dies, eliminating drilling them out. With a little care and a new, sharp saw it is not difficult to saw within $\frac{1}{64}$ in. from the layout lines, providing the work is properly set up and a light feed is used.

For a rectangular die, the starting holes for the saw should be drilled as shown in Fig. 1, and not in the corners, because holes so drilled would leave too much metal to be removed by filing. For a die having an opening like that shown in Fig. 2, the end holes should be bored in a lathe and the starting holes for the saw should be drilled midway between them.



Saws can save time in making dies by starting cuts right

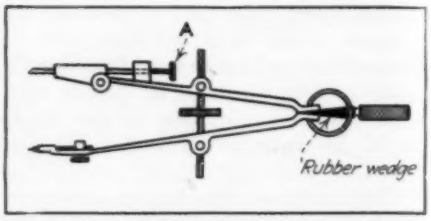
During the sawing operation, the watchful eye of the operator should be kept on the junction of the lines, not depending on the automatic stop of the machine, otherwise the cut may pass the junction and the die may be spoiled.

Reinforcing the Springs of Bow Pencils
Discussion

ADAM FREDERICKS

The method of reinforcing the springs of bow pencils as portrayed by C. A. Johnson (*AM*—Vol. 77, page 284) takes care of but one type of instrument. By his method the rubber insert is compressed when drawing small circles where it is not needed so much as in drawing large circles. If too thick a piece of rubber is used the range of the instrument is necessarily limited, as the compression will be too great for small work if the instrument is to be efficient on large work.

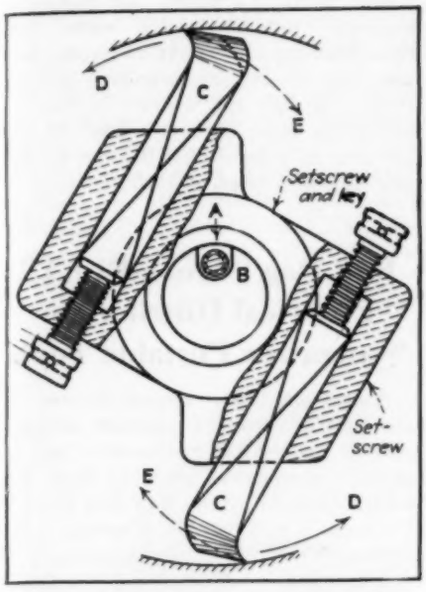
The accompanying sketch illustrates an effective automatic adjustment for dividers of the circular-spring type for drawing circles up to 5 in. in diameter. A rubber wedge is placed inside of the spring, the thin end going between the upper parts of the legs. When small circles are drawn the rubber is ineffective, for the spring is under its maximum tension. In drawing large circles the spring loses much of its tension and it is then that the rubber wedge comes into action, taking up the backlash in the right- and left-hand screw and its nut.



Rubber wedges and stop screws for the lead make bow pencils better

Another annoyance to the draftsman using a worn bow pencil is to have the lead continually slipping up in its socket because the binding screw has not enough gripping power. The remedy is to solder a brass lug to the pencil leg above the lead socket. The lug is tapped for the little knurled-head screw *A*, which acts as a stop to prevent the lead from rising when it is borne hard on the paper, keeping it in correct relation to the needle point.

When it is necessary to outline circles in various colors, instead of going free hand with a colored pencil over a circle that has been drawn in black pencil, regular dividers having two inserted needle points can be used by substituting a thin lead of the desired color for one of the needle points. Such leads are used for refilling pocket pencils and are available in almost all stationery stores. This method will insure clean, smooth lines and improve appearances.



Preventing chatter in boring by setting the tools tangentially in the head

panying sketch, it will be found that such a provision will go far toward prevention of chatter.

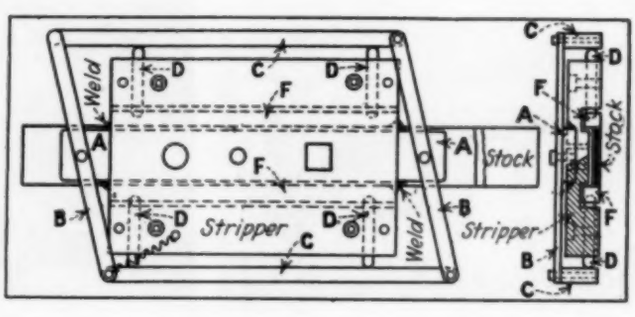
Referring to the ilustration, *A* is the traveling head and *B* is the boring bar; *C-C* are the tools in tangential seats and rotating with the head in the direction of the arrows *D-D*. The arrows *E-E* indicate the direction of spring of the tools under stress of the cut. These two arrows clearly show the releasing action resulting from the tangential setting of the tools. The behavior of the tools is similar to that of the gooseneck tools used in shapers and planers, though less in degree, but usually with desirable effect.

Centralizing Strip Stock in Press Tools

CHARLES KUGLER

Strip stock that varies in width can be centralized by the device illustrated. The device can be attached to almost any press tools without interfering with their operation in any way.

Two pieces *A* are welded to the ends of the stripper, serving as brackets to which the levers *B* are pivoted. The parallel links *C* are pivoted to the levers and are in contact with the sliding pins *D*, which operate the stock guides *F*. The inner corners of the guides are rounded at one end to provide easy entrance of the strip. The spring imparts uniform tension to the levers, and through them, the links and the sliding pins to the guides.



Here is a device that can be attached to almost any kind of press tool for keeping the stock central as it feeds through

SEEN AND HEARD

JOHN R. GODFREY

Care in Motor Building

I never cease to be amazed at the care that goes into the building of the modern automobile engine. Regardless of price the endeavor to have the motor as near perfect as possible when it leaves the assembly line is extremely interesting. Spending from 15 to 60 cents to balance a crankshaft to close limits, tearing a motor completely down after the test block run to catch scored bearings or cylinder walls or imperfect seating of valves, in motors to go into cars in the lower price class, indicates the endeavor to give full value. Thorough washing with kerosene after many operations, careful selection of pistons, piston pins, gears and other parts, all add to the life of the modern motor. Thousands of miles of service are built into every modern motor, regardless of price.

Cutting Oils Again

We are still learning about cutting oils. The maker of a centrifugal machine for taking out the impurities after the oil has been used sends me a sample of the stuff removed. It seems to be first cousin to asphalt. At first thought it gives the impression that it must have come from turning some sort of plastic material. But it came from a metal cutting machine and is apparently due to excessive heating of the oil at the cutting edge of the tool, which breaks down the oil particles and forms a resinous deposit. This might indicate that we need another kind of oil, or enough more of it to keep the cutting cool enough to prevent this effect. But until we get 100 per cent efficiency, which is not likely to be very soon, it looks as though an oil clarifying system should be a part of the shop equipment.

Nickel Cast-Iron Cuts More Freely

Hardness and machinability have very little in common in many cases. Nickel irons make harder cylinders but according to one authority they machine more easily than iron without nickel. Here's what he says:

"One-half inch tools, ground to Taylor angles and round-nosed, cutting dry, will machine cast iron containing up to 1.25 per cent nickel at a rate varying from 20 to 80 per cent faster than nickel-free iron of the same Brinnell hardness. A cut ⅛ in. deep, ¾ in. feed, might be taken at 120 to 180 feet per minute as against about 95 feet per minute for plain iron. For larger tools, say 1 in. square, the speeds would be about 10 per cent higher. These figures apply to ordinary cast iron of the soft or medium types. The hard irons, similar to automotive cylinder blocks, or Diesel liners, can be cut at approximately twice the speed of ordinary plain iron, which means that the ½-in. tool mentioned above will cut them at 100 to 150 ft. per min. as against 60 ft. for plain gray iron. In many cases two irons of the same Brinell hardness, but one of which contains nickel, demonstrate the fact that the nickel-containing one can be machined whereas the other cannot be cut at all at any speed without tearing the nose off the tool."

This seems to be a case of making harder, longer wearing iron and cutting it at higher speed than the softer irons.

Grinding With a Tube Cleaner

Invention frequently beats necessity to the job as I've pointed out on previous occasions. But necessity often jars us out of ruts and we grab a new tool for an old job. A steel tube maker had a contract for a bunch of stainless steel tubes 3½ in. I.D. and these tubes had to be smooth. The grinding process struck several snags and the time limit, with penalty, was staring him in the face. Some bright boy grabbed an air driven boiler tube cleaner, stuck a grinding wheel on the end and started business. This worked so well they ordered five more and kept the whole half dozen on the job 24 hrs. a day. They used wheels a little smaller than the bore of the tube, pushed the cleaner with its wheel in the end and rotated the tube as they pushed the cleaner ahead. The job was O.K. and there wasn't any penalty to pay.

SHOP EQUIPMENT NEWS

"Automatic" Type 305 Multi-Position Controller

For controlling industrial furnaces subject to wide variations of heat demand over varying periods, the Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa., has developed the Type 305 multi-position controller. For example, it can be used to control a continuous-type heat-treating furnace located in the line of production and subject to changes in rate of flow of the work treated. Such a furnace may run practically empty for short periods and the control mechanism, while primarily selected to maintain the furnace within close limits of the temperature setting during periods of normal operation, should likewise hold the temperature setting when these interruptions occur and when more or less sudden resumption of the furnace load takes place.

The instrument has five separate contacts, two either side of the normal setting, or the equivalent, which can be obtained through the use of available relays. Through a positive limit switch arrangement, each intermediate contact between the extreme low and the extreme high contacts in the actuating instrument has two definite valve positions, so that on making one of these contacts, following a drop in temperature, the valve opening and hence the resultant fuel supply is greater than when the same contact is made following a rise in temperature. Thus, it is possible to assure a fuel supply more consistent with the fuel demand. It is claimed it is possible to get close control without hunting. The motor used is a series-wound, split-field type and can be supplied for 110 or 220 volts, a.c. or d.c.

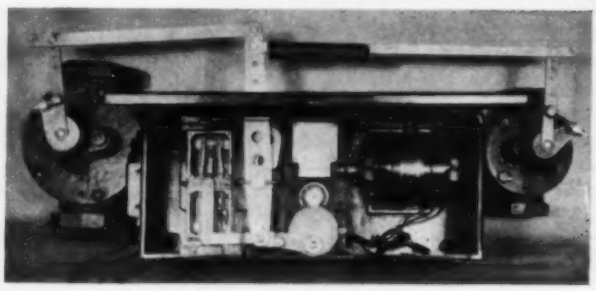
Brown & Sharpe No. 210 Centrifugal Motorpump

A large volume of liquid under relatively low head can be handled by the No. 210 centrifugal "Motorpump" developed by the Brown & Sharpe Mfg. Co., Providence, R. I. The pump is adapted for supplying coolant and liquids that contain dirt, chips or abrasive particles. The design permits mounting the pump either outside or inside the tank. A discharge pipe can be carried vertically, with clearance from the motor, eliminating the necessity for elbows for making an offset. The motor is of the drip-proof type. In addition to the two motor bearings, a sealed ball bearing is employed just above the water line. Specifications: Speed, 1,725 r.p.m.; suction pipe, 1½ in.; discharge pipe, 1¼ in.; motor, ¼ hp.; net weight, 53 lb.; capacity for pumping soda water, 45 gal. per min. at a head of 8 ft., and 15 gal. per min. at a head of 15 ft.

Bull Dog "Trol-e-DUCT" Electrical Distribution System for Portable Tools

A duct and trolley system for conveying electric current to moving or portable electric devices, particularly such as used on continuous assembly lines, has been developed by the Bull Dog Electric Products Co., 7610 Jos. Campau Ave., Detroit, Mich. The system consists of standardized, self-contained sectional units of steel duct, inclosing insulated busbars which distribute electric current through trolleys to portable electric tools or other moving loads. When the system is used in connection with continuous assembly lines, the electric tool can be made to move forward as the product advances. In addition, the use of plug sockets and loose wires is eliminated.

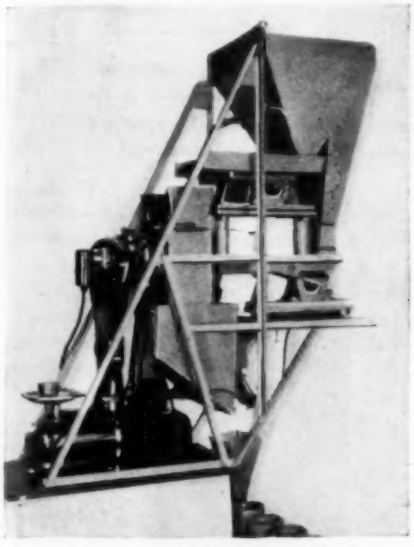
"Trol-e-DUCT" is a standardized product of sectional unit construction, is salvageable and interchangeable. Movement of the carriage and trolley is facilitated by ball bearings, and good electrical contact is maintained. Duct and trolleys are made for single and three-phase circuits. When assembled, the live parts are completely inclosed.



Maintenance of the temperature of furnaces subject to wide variations of heat demand is a function of the "Automatic" Type 305 Multi-Position Controller

Toledo Improved Weighing and Filling Device

Small metal products can be weighed and placed in packages by the improved precision weighing and automatic filling device announced by Toledo Precision Devices, Inc. and marketed by the Toledo Scale Co., Toledo, Ohio. This device will weigh as high as 1,000 1-lb. packages per hour to an accuracy of ⅛ oz. All drafts are net weighings, the weight of the container not being included. Breaking, cutting, and crushing of the commodity are practically eliminated. Errors are prevented because the device is electrically interlocked against inaccuracies due to mechanical faults. The predetermined net weight can be easily checked at any part of a run by pressing a button.



Small parts are weighed and fed into containers at the rate of 1,000 1-lb. packages an hour on the Toledo Precision Weighing and Automatic Filling Device

Armco Deep-Drawing Steel

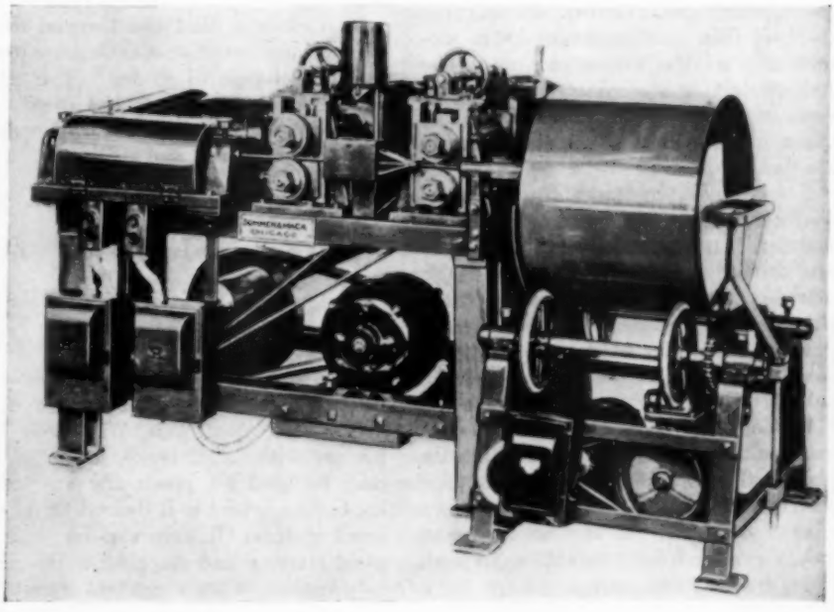
A deep-drawing sheet metal developed by the American Rolling Mill Co., Middletown, Ohio, is said to have the following properties: high ductility; uniformity of physical properties; ductility not impaired by temper cold rolling; permanent freedom from stretcher straining in the tempered condition, and no change with lapse of time in respect to ductility, yield point, tensile strength, and hardness. Stretcher strains are prevented by small amounts of temper cold rolling and do not recur even after aging as long as one year at room temperature. A better quality surface is achieved through the absence of stretcher strains, which is of value to the auto body builder and other users of high finish deep-drawing sheets. Deviations in Rockwell hardness and tensile strength in a large number of sheets are said to be scarcely more than that attributable to the variations in the test itself. The material is free from blue brittleness.

"Aristocrat" Tape-Rule

An embossed design with a background in black enamel is used for the stainless steel case of the "Aristocrat" tape-rule now being marketed by The Lufkin Rule Co., Saginaw, Mich. This 6-ft. measure weighs 2 oz., and the case is 1⅝ in. in diameter. The steel line can be projected unsupported like a rule and will flex around and accurately measure objects. No. 186 is graduated 72 in. to 16ths, and No. 186D in engineers' measurement.

Somaca Wire Cutting Machine

Welding wire or other wire can be cut to various lengths on the wire cutting machine developed by the Sommer & Maca Glass Machinery Corp., 3600-3608 S. Oakley Ave., Chicago, Ill. Production of welding wire is approximately 300 pieces, standard length, per minute, but a production of as high as 3,600 pieces per minute may be obtained on short lengths for other purposes. An arrangement can be provided whereby the wire receives a coating at the same time. The machine carries one 3-hp., one 2-hp., and one 1½-hp. motor. Power is transmitted to the drive shaft by means of V-belts.

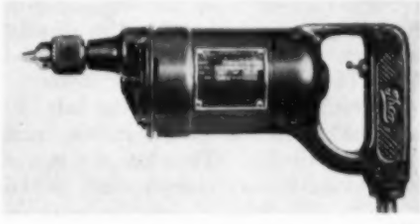


Taylor Steel Fittings for Light Wall Piping

Reduced weight is a feature of the fittings now being offered for light wall piping and Taylor spiral pipe by the Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill. These fittings are fabricated from No. 10 gage steel by welding and are die-formed. Center to end dimensions conforms to the 125-lb. American Standard. Fittings are furnished plain end or flanged, or flanged at one end only. They are suitable for hydraulic pressures of 200 lb. per sq. in. or more in smaller sizes. The fittings are easily welded into piping installations.

Thor 1/4-In. Light Duty Electric Drill

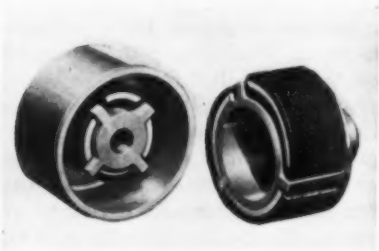
A ¼-in. electric drill weighing 5 lb. has been developed by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This "Thor" drill is equipped with ball bearings on both ends of the armature and with hand wound and formed coils. The commutator is a separate unit, built on a brass sleeve that expands and contracts with the copper segments to make sure that the segments do not work loose and rise.



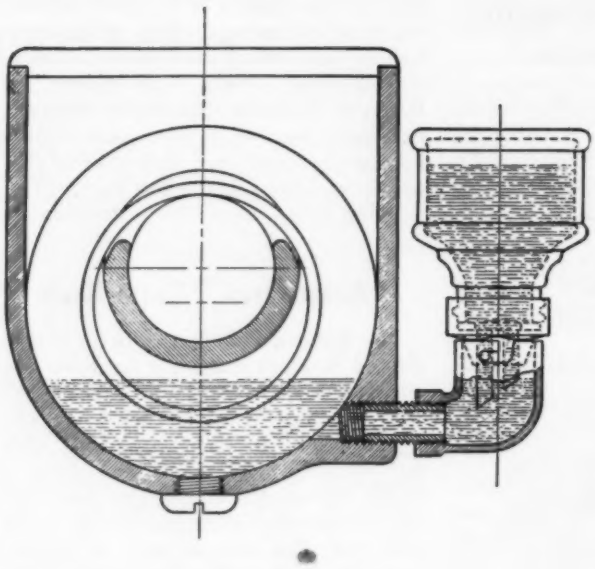
It has a dust-proof toggle switch placed inside the handle. The tool runs at 2,200 r.p.m., has a length over-all of 11¼ in. and a spindle offset of ⅞ in.

Falk-Rawson 4-Duty Coupling

The four functions of the Falk-Rawson 4-duty coupling now being marketed by the Falk Corp., Milwaukee, Wis., are: starting, coupling, cushioning and limiting the load. The primary duty of the coupling is as an automatic starter, centrifugally operated. The construction involves two drum-shaped members, one attached to the driving shaft and the other to the driven shaft. Between the driving and driven members are inserted two sets of floating segments, made usually of brake lining reinforced with lead, the amount of lead being calculated to give the required centrifugal pressure for carrying the load. Outer segments are actuated by the driving member, the inner by the driven member. The coupling allows the motor to start without external load, the only resistance being its own inertia and negligible friction. Therefore the motor gathers speed very quickly, and, as the starting shoes take hold, the machine builds up speed, actuating the driven shoes which add further starting capacity. The motor slows down momentarily as the load comes on. The jerk of starting is eliminated and the inrush of current is greatly reduced because of the extended time of starting the load.



The coupling provides for moderate shaft misalignment, both parallel and angular, through the clearance between the driving and driven drums and also affords torsional shock absorption to the drive. In the standard application the combined capacity of driving and overload shoes is equal to 140 per cent of normal motor running torque. Above this load the shoes slip momentarily, cushioning the shock and protecting the drive. The device can also be applied as a protective or braking device against excessive speeds. It is built in horsepower ratings from 3 to 400, and speeds from 495 to 1,760 r.p.m.



When oil in the jar gets below the short tube, air flows into the jar, oil passes down the long tube until it seals the short tube again

Speedway Automatic Oilers

Two types of oilers have been introduced by the Speedway Mfg. Co., Cicero, Ill. The "constant-level" oilers are designed for use on electric motor bearings and other reservoir bearings with oil ring, packing, or ball or roller bearings, where oil in the reservoir should be maintained at a determined level. The "thermal" oilers are applied to machine bearings and are automatic in operation.

The accompanying illustration shows how the constant-level oiler works. The oil level in the bearing is held at the same height as the opening of the short tube in the inverted bottle cap. As soon as the oil gets below this level, air enters the jar through the tube, and oil flows out through the long tube until the level is raised enough to seal the air opening in the short tube. Thus the oil level cannot vary more than a fraction of an inch.

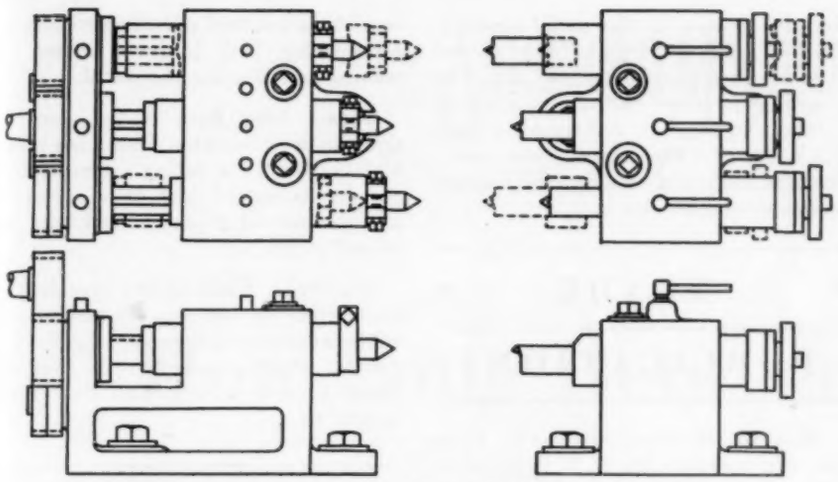
It is claimed that the thermal oilers for machine bearings operate on a temperature change of 2 deg. The glass bottle shows when oil has been exhausted. When empty, the wide-necked bottle is unscrewed and refilled.

Furnas Style R1 Drum Switch for Reversing Small Motors

The Style R1 drum switch was developed by the Furnas Electric Co., 1525 S. 77th St., West Allis, Wis., especially for use with small bench lathes but it may be used for practically any other application where it is desired to reverse small motors. It may also be used for plain starting and stopping where accurate control is an important consideration. Interior metal parts and frame are cadmium-plated, while the top, cover, handle stem and cap are bright nickel finish. The handle knob is of bright-red bakelite. Weight is 17 oz. net. The drum switch will control ½-hp., a.c. motors and ¼-hp. d.c. motors.

Stevens Three-Spindle Adjustable-Angle Spiral Index Centers

John B. Stevens, Inc., 304 Hudson St., New York, N. Y., has developed 2-in., 3-spindle, adjustable-angle spiral index centers designed for use on universal milling machines. The centers are used in connection with the regular dividing head and spiral setting parts of the machine for the multiple milling of straight or spiral flutes, slots, ratchets and gears. In reality, this attachment is a multiple-spindle extension for a dividing head. All three spindles rotate in the same direction. The spindles are driven by a gear placed on a taper shank arbor, the latter being placed in the machine dividing head spindle while in horizontal position.



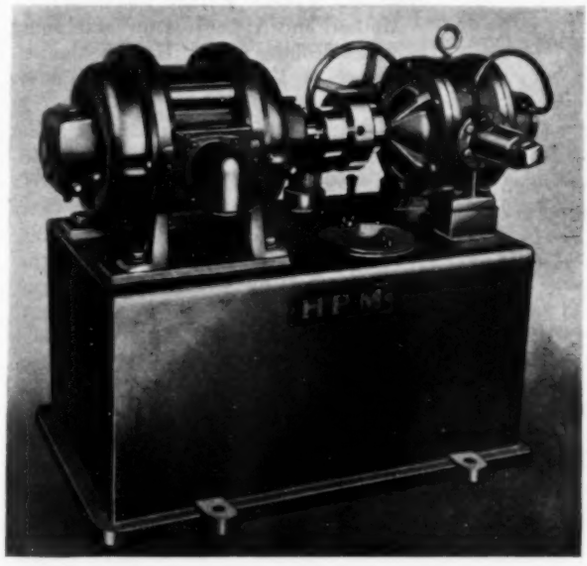
Stevens Three-Spindle, Adjustable-Angle Spiral Index Centers for multiple milling of straight or spiral flutes and slots

Dimensions: Rated swing of spindles, 2 in.; distance between spindles, 2 1/8 in.; Morse taper, No. 1; hole through head spindles, 3/4 in.; height of centers (dividing-head spindle height 5 in.) 3 3/8 in.; cutter clearance over tail spindles, 3/4 in.; total length, spindles touching, 17 in.; total height, 6 1/4 in.; maximum angle obtainable, right hand, 17 1/2 deg.; left-hand, 17 1/2 deg.; weight, 80 lb.

"H-P-M" Power Units for Self-Contained Hydraulic Machine Drives

A line of standardized "Hydro-Power" units has been developed by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. These units incorporate a radial-pump pressure generator, direct-driven from an electric motor. Both pump and motor are mounted on a base inclosed to serve as a reservoir for the oil used as pressure fluid and lubricant. Each machine served by one of these units becomes self contained and independent of other machines.

Pressure output of the radial pump is regulated by an automatic control which may be adjusted for any value up to 3,000 lb. per sq.in. A modified form of this control is provided with a second adjustment whereby the volume of the pump discharge may be regulated to any amount from zero to maximum. The unit illustrated provides a single stage of high-pressure capacity up to 3,000 lb. per sq.in. or a medium pressure up to 1,500 lb., depending on the radial pump. When initial work or closing movements are to be performed at low pressure, a two-stage unit is recommended. This incorporates two pressure-generating pumps, plus a low-pressure rotary pump to provide larger volume for the initial portion of the operation. When the low-pressure limit is reached the output is by-passed at zero pressure by an automatic unloading valve which functions without shock.



Self-contained hydraulically driven machines may be built around the "H-P-M" Radial Pump Power Unit

"Microlux" Mirror Comparators

Marburg Bros., Inc., 90 West St., New York, N. Y., are introducing in the United States the "Microlux" mirror comparator which can be adapted to different purposes by modifying the measuring anvil. The test is indicated by a line showing against a circular illuminated background on the frosted glass screen. Four indicators are provided and may be set for minimum and maximum dimensions. Two of the indicators may be set for closer limits and two for wider limits, so that parts inspected may be separated into three groups: acceptable under close limits; acceptable under wider limits, and rejects. The indicators may also be set by means of one master gage to indicate the minimum or maximum dimension and the other settings may be in accordance with the scale on the instrument. The place where the part to be inspected is introduced and the screen on which the indication is read are close to each other, so that inspection is easy and not tiring.

By employing suitable anvils the "Microlux" Mirror Comparator can be adapted to a wide variety of work

In the Microlux comparator the amplification of error is 1000:1, so that an error of 0.001 on the part under test would displace the indicating line on the glass screen by 1 in. Two standard types are built besides a thread comparator. The first standard type has a range up to 2 in., and the second up to 8 in., while the thread comparator will determine whether the pitch diameter is within the tolerance limits and also its relation to the nominal size for

threads from ¼ to 1⅛ in. In both types work up to 20 in. long can be dealt with, using suitable bases.

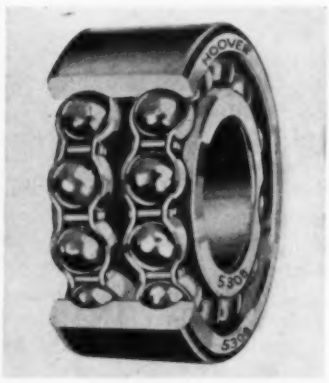
Trent Trough-Type Electric Furnace

The Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa., has placed on the market an electric furnace of the trough-type which can be used as a

heat-treating bath with lead or salts. The illustration shows the folded and formed furnace-type element and the method of lifting the trough crucible from the frame structure.

Hoover Double Row Annular Ball Bearings

Light, medium and heavy series, double-row ball bearings, identified as the Nos. 5200, 5300, and 5400 series respectively, are now being made by the Hoover Steel Ball Co., Ann Arbor, Mich. These bearings are of the deep groove type, having no filling slots or interruption of the raceways, and are said to have large thrust capacity in either direction, in addition to the radial capacity. Formed steel retainers of the riveted type are used for spacing the balls. The bearing is produced entirely from electric furnace high-carbon chrome-alloy steel S.A.E. 52,100. The company also manufactures single-row annular ball bearings and tapered roller bearings.



• TRADE •

PUBLICATIONS

BEARING BRONZE. Research Paper No. 551, issued by the U. S. Department of Commerce, Bureau of Standards, is entitled "Tin-Free Leaded Bearing Bronze." The paper is for sale by the Superintendent of Documents, Washington, D. C., for five cents.

FIREBRICK. A 16-page bulletin F-104, describing "Steel Mixture" oil brand firebrick for oil-fired furnaces and industrial furnace linings, high temperature fire cements, furnace linings and arches, has been published by McLeod & Henry Co., Troy, N. Y.

GRINDING WHEEL SPECIFICATIONS. The Norton Co., Worcester Mass., has issued a booklet "Grinding Wheel Specifications for Grinding Machines," showing grinding wheels used on the different sizes and styles of grinding machines made by different grinding machine manufacturers. Standard wheels are in accordance with the Simplified Practice Recommendation No. R45-32 issued by the U. S. Department of Commerce, while special shapes are so listed.

HANDLING EQUIPMENT. The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., is distributing a "Souvenir Book 1933 of the Link-Belt Exhibit at A Century of Progress." In the 48 pages are shown handling equipment of various types for many industries and the various types of chain produced.

NICHROME. Booklet R-33 compiled by the Driver-Harris Co., Harrison, N. J., covers the properties and characteristics of its alloys for electrical, mechanical and chemical purposes. The company will send copies at 25 cents each to cover postage and part of the cost of publication.

PLATING WITH CAD-A-LOY. An "Operating Manual for Plating with Cad-A-Loy" has been issued by E. I. duPont de Nemours & Co., Inc., the R. & H. Chemicals Department, Wilmington, Del. This treatise on the cadmium-mercury process for plating iron and steel parts contains information on the complete plating operation including the preparation of the solution, operating conditions, replenishing, bath analyses, testing the coating and cleaning the metal.

TAPS. John Bath & Co., Inc., 18 Grafton St., Worcester, Mass., has issued Catalog No. 12-A calling attention to a revised listing of high-speed precision and commercial ground thread taps and thread gages.

STARTERS. Class 11-204 combination linestarters for squirrel-cage and wound-rotor induction motors are described in Leaflet 20,499 issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

• PATENTS •

JULY 11, 1933

Metal-Working Machinery

Press Mechanism. Richard W. Dinzl, Margate City, N. J., assigned to Southwark Foundry & Machine Co. Patent 1,917,241.

Ball Race Grinder. Amos P. Steiner, Edgar P. Wine, and Harold E. Balsiger, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,917,468.

Cutter Grinder. Frank W. Curtis, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,917,504.

Machine Tool. Herbert L. Tigges, Toledo, Ohio, assigned to Baker Brothers, Inc. Patent 1,917,616.

Machine Tool. Walter M. Fairbairn, Rockford, Ill., assigned to Barnes Drill Co. Patent 1,917,831.

Drilling Machine Spindle. Albert M. Johnson, Rockford, Ill., assigned to Barnes Drill Co. Patent 1,917,842.

Machine Tool Feeding Apparatus. William L. Schellenbach, Wyoming, Ohio. Patent 1,917,905.

Dieing Machine. Cortis F. Sherman, Hartford, Conn. Patent 1,918,059.

Method and Apparatus for Machining Rolls for Rolling Mills. Hans Schimmel, Komotau, Czechoslovakia. Patent 1,918,139.

Multiple Head Automatic Drilling Machine. Gunnar Swahnberg and Edward Joslin Kingsbury, Keene, N. H., assigned to Kingsbury Machine Tool Corp. Patent 1,918,150.

Gauging Mechanism for Internal Grinders. Hilding Valdemar Tornebohm, Gottenborg, Sweden, assigned to Aktiebolaget Svenska Kullagerfabriken, Gottenborg, Sweden. Patent 1,918,198.

Tools and Attachments

Screw Thread Gauge. James Hartness, Springfield, Vt. Patent 1,917,301.

Lathe Attachment. John Y. Blazek, Cleveland, Ohio, assigned to Lempco Products, Inc. Patent 1,917,748.